AMERICAN MACHINIST

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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Compound Condensing Duplex Pumping Engine.

The engraving represents a four-million gallon pumping engine, as built for Fremont, Ohio, by the Knowles Steam Pump Works, of New York and Boston.

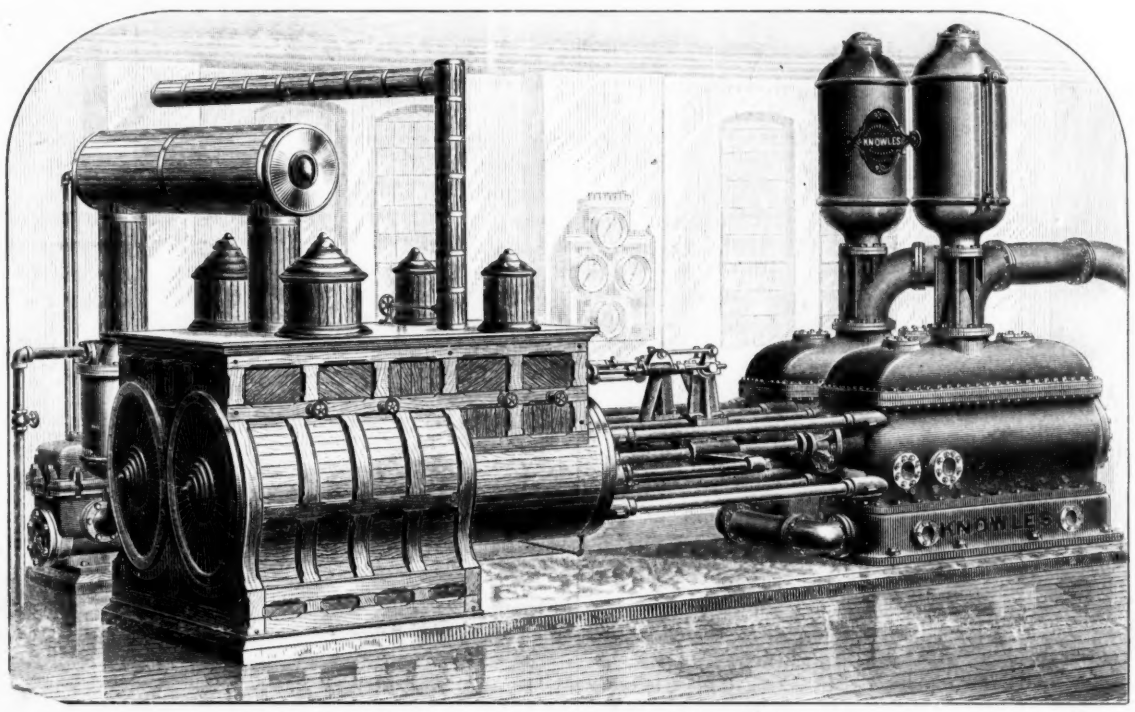
This engine is provided with an overhead heater and balanced steam valves. The steam cylinders are steam jacketed at sides and ends, and handsomely lagged to prevent radiation.

The piston of each of the high-pressure cylinders is fitted with one piston rod, and that of the low-pressure cylinders with two piston rods, all connecting with one crosshead, with stuffing boxes at the front and in line, so as to be readily come at for packing.

The pumps are provided with separate air chambers.

An independent air pump and condenser is used.

Altogether, the engine, complete, presents a very neat and creditable appearance, and is fitted with all the convenient and economical appliances and improvements peculiar to these pumping engines.



IMPROVED COMPOUND CONDENSING DUPLEX PUMPING ENGINE.

Shingle, Heading and Box Board Machine.

This machine is automatic in set and feed. The carriage slides on planed iron ways, and is moved by a hardened roll working in a heart cam, which gives a slow uniform forward and quick return movement.

The length of run of the carriage can be changed by raising or lowering the connecting rod in the slot on the side of the swing lever.

Three different feeds are given by the cone pulleys,—16, 28 and 40 cuts per minute, with the saw running 1500 revolutions. A faster speed on saw will of course give more feed.

The heart shaped cam is made on the side of a gear-wheel which is driven by a pinion on the feed shaft, hung in adjustable boxes on the back legs of the frame. This feed shaft has a large cone pulley, running loose when the carriage is at rest, and provided with a friction clutch on the hub of the pulley, starting or stopping the carriage instantly by a slight motion of the shipping lever.

Two shipping levers are provided by which the carriage can be instantly started or stopped,—one at the end of the machine convenient to the operator when putting in the block, the other by the side of the jointer. The one by the side of the jointer is provided with an automatic stop, so that if slightly pushed in by the hand or knee of the operator at any time, the carriage will stop at the end of the stroke in position for a new block.

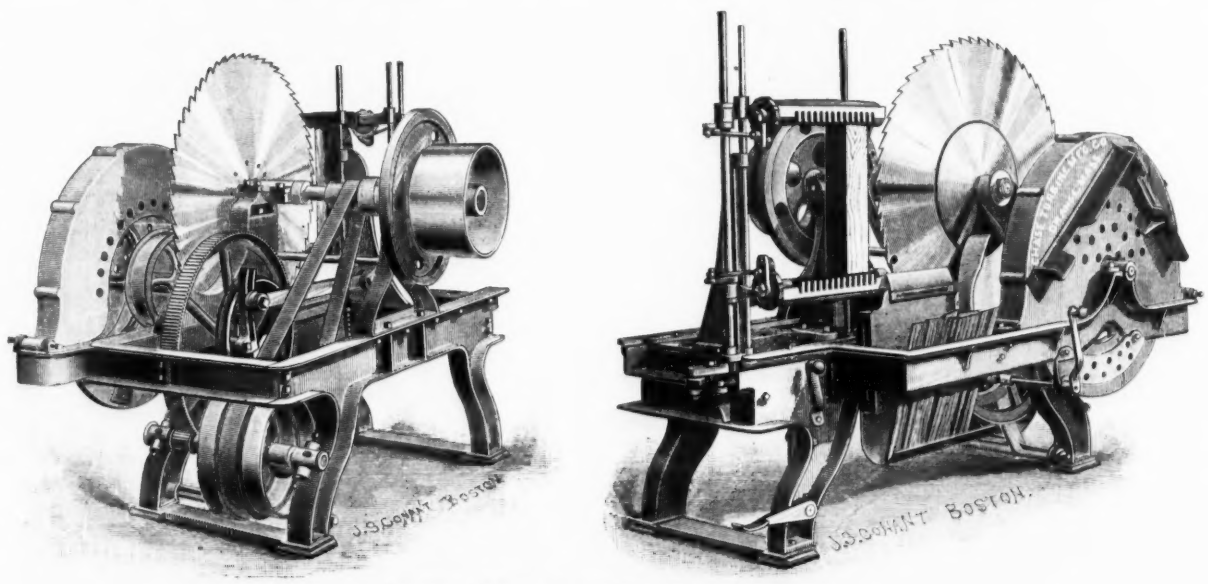
The set rolls are made of solid steel, the teeth are long and sharp so that a firm hold is taken upon the block; both rolls are adjustable, thus enabling the machine to saw blocks from 10 to 30 inches long, and have the saw always cut to the center of the block. The top roll is held down by heavy coiled springs underneath the carriage, and is raised, to take in a new block, by a treadle, thus allowing the operator the use of both hands. The setting is done by ratchets on the ends of the set rolls, operated by spring pawls connected by bell cranks to an upright rod which is rotated by a simple mechanical movement, giving a positive and uniform set, and is not affected by the position of set rolls.

The jointer is turned perfectly true and balanced, and carries five knives; it is driven direct from the arbor and is in such a position that the operator does not have to change his position, or turn his body even, when jointing. It is covered with an iron case, easily removed, and provided with places for two men to joint at the same time. The jointer can be detached from the machine and set in some other place if desired.

The shingle box is made of wrought iron, so shaped that while it will catch the shingles it will not fill up with sawdust. It is adjustable, to conform to the position of the lower set roll, and is provided with a cast iron plate on the upper edge, with a place cut out for the points of the teeth, and adjustable to different sizes of saws.

This machine will cut shingles, heading or box boards, from 10 to 30 inches long, and from 4 to 15 inches wide, according to size of saw and length of block.

The manufacturers are the Chase Turbine Manufacturing Company, Orange, Mass.



SHINGLE, HEADING AND BOX BOARD MACHINE.

Tom Discusses the Grindstone Question—Clearing Up.

BY JAMES F. HOBART.

"Hello, Tom! Hello! Good morning to you, how do you feel this morning?"

"First class, sir, never felt better in my life."

"Is that so? Why, I expected to find you all bunged up, both eyes blacked, your nose skinned, and one ear bit off."

"What made you expect that?"

"Expect it? How in thunder could I help expecting it, after reading how you had been sat down upon in the AMERICAN MACHINIST of May 2. Why you had ought to be spread out thin as a flap-jack, and ten feet square, but here you are, fat and homely as ever."

"Now, look here, Mr. Hobart, what are you trying to get at, any way? I don't tumble or catch on worth a cent."

"You read last week's AMERICAN MACHINIST, didn't you, Tom?"

"Read it? Well, I guess I did. You don't expect that I ever go home Wednesday night without the MACHINIST in my pocket, do you? Well, I guess not. Why, I had rather go without my supper, than miss reading my pet paper."

"Well, then you must have read 'Grinding and Using Cutting Tools,' on page second."

"Oh, yes. I read it."

"And it didn't tear you all to pieces, and completely demoralize you?"

"No, not a bit, as you see."

"Ah, Tom, Tom; no wonder that our critic asks if you ever got left. We know you got left this time, because you were too tough to do anything else with."

"Hold up, Mr. Hobart, I begin to see what is the matter with you, and I tell you, I was tickled when read 'Dick's' article under your old heading. Let's go down to my house, and after supper we'll crack walnuts and talk it over."

"To tell the truth, I think your article under the same heading, in issue of April 18, was the best one you have written for the AMERICAN MACHINIST."

"How in the world do you make out that point?"

"Make it out? Why it makes itself out. Don't you see how? It has created discussion, that's just how. Come right to the point now, and tell me if that is not just the thing you are working for? You don't care a cent about telling folks what they know

although they like to read something they know all about, and then hug themselves, and say, 'well, I know as much about that thing as he does himself.' You want to write something that will set them to thinking?"

"Just so, and about the quickest way to do that, is to tell them something they don't quite believe."

"Good walnuts, you say? Well, they do crack pretty well. Which cracks up the best, the discussion or the nuts?"

"No. I don't think I shall go to Mr. 'Dick' for a job just yet. It would be too much like working for the English doctor, who advertised for a man to act as 'cured patient' around his office, and perhaps I did get the wrong side of the stone, but if I did, I haven't found it out yet; and I have tried both sides to my satisfaction. I wonder if Mr. 'Dick' ever tried our way of grinding? Let's ask him to tell us. He's right about one thing any way, and that is about a man being in a hurry at the stone. There is one place where he can't hurry his man, and that is in hurrying him to the grindstone. That chap will use a tool until it looks like the point of an iron bar, and then get mad and swear, because he can't grind off $\frac{1}{8}''$ of steel in ten seconds. No wonder he went almost into the trough.

"That $\frac{3}{4}''$ square, iron-clamped to the frame for a rest, is a pretty good thing, but we use one 3″ square, and have a truing device clamped on the other side. The cover of the truing rig runs within $\frac{1}{4}''$ of the stone, and that cast-iron cover is just where we rest our tools when we give an example of all that is vicious and execrable in tool grinding!

"The other day, a chap came along and slapped a side tool down on that 3″ rest and began to 'grind fast.' Pretty soon it caught. The point dug into the stone. The tool turned in his hands and drew down between the stone and rest, caught the fellow's knuckles against the stone and proceeded to skin them forthwith."

"Well, Tom, I guess you are about right about the grind fast business, and Mr. 'Dick' is too. We all admit that the front of a stone is the place to get rid of lots of steel, but when we have got a nice job of grinding to do and must do it on a grindstone, then we 'dodge around behind the stone.'"

"Now look here, Tom, I don't know which will get the best of it on the tool question, you or Mr. 'Dick,' but if you settle his case as quickly as I will settle his enquiry about the scratched post business, then his time is short. That post stands in a shop in the town of Pepperell, Mass., and Mr. 'Dick's' request for a photograph will be granted in a very short time. We never knew of any tools being scratched before they were tempered, and so conclude that all the 'standard machinists' in that shop had one of the complaints of the horse he likens to you, Tom. 'What's that' you say? Why the scratches of course."

"I can't help wondering where you have passed your days, Mr. Hobart," said Tom as he threw a wormy walnut at a stray cat, which looked in. "Well, Tom, we passed lots of them where they ground thread tools like J in the sketch, and we ground them on an Ohio stone, which had just two good corners and was not 'demoralized' a bit. And we put in some more days trying to figure out Mr. 'Dick's' solution of the twist drill question, and we get it that the twist drill cuts 123 square inches of surface, for each and every cubic inch of iron it removes, while the tool at the engine shaft cuts only 40 square inches to remove the same quantity. How's that, Mr. 'Dick'? And one thing more while we are at it. Just you try to drill a $\frac{1}{2}''$ hole 12″ deep with a flat drill in brass or any metal like it, and tell us whether you had rather grease the drill, or plug your ears. And we shall stick up for the straight diamond point tool without any side rake as stated April 18, but now we are going to acknowledge the corn and pull in our horns a little. Tom says, 'Now, a thread tool don't need to have any side rake to cut either left or right-hand threads, *unless it is for threads on small iron with a large pitch.* His italics are all right as far as they go, but don't cover the whole ground. And, as you say, side rake should be 'properly adjusted' to fit the thread in hand, but not to help the cutting qualities of the tool, for both you and myself have cut hundreds of left and right threads with the *same tool.*

And about one more bull's eye you made. You struck plumb center in your last paragraph. A man in the American Machinist speaks to more people than any lecturer ever faced, and they are a pretty intelligent set too. They are apt to bring a man right up standing when he gets on the wrong tack.

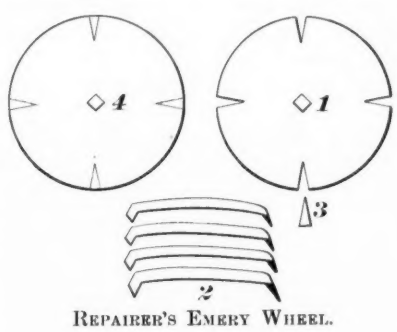
As before stated, discussion is what we are after. If we get both sides of the story then we are sure of the truth every time. All men don't think alike, and the old saying is true as ever that, if they *did* all think alike, then there would be trouble, for they would all be courting the same woman!

I extend hearty thanks to Mr. "Dick," and hope "Richard's himself again" after his brush with Tom, and that he will come "early and often." I shall soon visit the town where the "scratched post" lives, and will be able to fill orders for photos of that curiosity.

While upon the tool subject I wish to ask each and every machinist how he takes care of the tools he uses every day. Don't squirm out of the question, snarl up your nose, and take a chew of tobacco. Take the question right home to yourself. How are your tools? Are they all clean and bright, the corners sharp and smooth, and the handles nice and whole? Or do you keep everything around your bench covered with slush? Look at those taps and dies. It takes you five minutes to scrape off dirt enough to let you see what is the pitch of the dies in the stock. It takes two minutes more to whittle down the ends of the pair you want to get into the stock, and then you are apt to get one of them in wrong side up, and instead of cutting a 16 pitch, right-hand thread, you turn out the neatest 32, left-hand thread, that you ever saw. Don't think this is a sure thing every time, and take out a patent on it; for if the dies are made in such a manner that they will reverse and let the threads exactly number, then you can never do it. If the slot which holds the dies is milled $\frac{1}{64}''$ out of the center of a thread, then, if one die is turned over, you stand a chance of getting a 32, left-hand thread. The first we ever saw of that business was a $\frac{3}{8}''$ steel bolt and a pair of old "squash" dies. A V groove was cut in the ends of the dies, and traveled on ways in the stock. The dies had got badly worn. They shut by each other $\frac{1}{32}''$, and we found a nice 32 left-hand thread on our bolt in place of the right hand 16, which we expected.

Better look at the bolt cutter also, and see if that tool is visible. Almost pay to "try it out," wouldn't it? About $\frac{1}{4}''$ of grease all over it, and $2\frac{1}{2}''$ of dried grease, dirt, and corruption on the floor underneath it. Take the machine all to pieces. Set the boys to scraping. Get a big kettle on the stove or on the forge, and put in some water and a paper of potash. Put all the small parts of the machine in the kettle and boil them; pick up all your nasty gummed-up taps and dies, all the nasty oil cans, and put in that monkey wrench that Jake oiled with black oil. Boil out all the grease, and put in potash enough to cut all the oil and dirt. Get all the tools cleaned up, and then—keep them clean, if you don't do anything else.

Look at your bench. "Can't see it?" Well, no wonder. It looks like a junk shop! Pieces of iron, nuts, washers, iron filings, square, dividers, castings, a core box, twelve files, nine cold chisels, one hammer with a carriage spoke handle, one hammer with cracked handle, two extra spokes, a sewing machine, and a gun lock! We will not say anything about the arbors and dogs that are mixed in; or speak of the three chucks, the steady rest, old belting, or the oil can that Mike tipped over among them. What's that in your hand? "A scale?" Guess not. It was a scale once, perhaps, but not now.



Repairer's Emery Wheel.

The corners are all worn off. You can't tell the figures. It is bent, one end is twisted, and yet you call that thing "a scale" and pretend to "work to it."

A scale will wear out as well as anything else. A scale gets "scaley" after two or three years' wear and tear around such a bench. What a nice time you have trying to work at such a bench. How the little tools hide under the old junk, or crawl off and drown themselves in the grease puddles. Why don't you get ashamed once in a while and clean up? "Haint got time." Poor excuse, that. You had ought to be turned over to the board of health and have them prepare you for the cholera, and your boss deserves to live in a spring-cleaning for ten days.

Put a little style to your bench, and put things where they belong. See how much easier the work goes along when you can see a clean bench in front of you.

Wipe off taps and dies when you are done with them. Don't throw them down whenever you happen to get done with the job. You never saw a nice workman do it so. You never saw $\frac{1}{16}''$ of grease on any of his belongings, or caught him using a broken file or spoke hammer handle. He knows that his work will look just like his tools. Put the chap with the slouchy tools on a nice job, and you will get slouchy work every time. He never does a thing just right. No! He can't. He will fuss and bungle, rip and tear, until it is "good enough," and then he will slouch off, bang his wretched tools down on the dirty bench, wipe his nose on his nasty shirt sleeve, and loaf until Boss comes around with another job.

Boss must stand some of this dirt racket. You never saw a dirty shop have a tidy Boss over twenty-four hours. The Boss will either get dirty himself, clean up the shop—or leave. You can't keep clean men in a dirty shop, or keep a clean shop with dirty men. About the best way to clean up the shop is to get a new Boss, and then give the men a chance to clean themselves.

How do your men go home to dinner or supper? Do they sneak off through back alleys with faces all smut, shirts covered with black dirt and gudgeon grease, or do they all hustle around a big trough like a drove of hogs, and each mix his dirt with his neighbor's, and then rub it in deeper? Or have you rigged each man a chance to wash himself clean? The Boston and Albany repair shops give their men a chance to go home with clean faces. They have got a double sink, forty feet long. It is well supplied by water from two pipes. Each man has his basin to wash in. There is no water in the sink. Every man takes his soap from under his dish, washes all he wants to, draws water from a faucet between each two men, and goes home clean and decent. Twice a week Bob has to scour up those basins and scrub out the sink. It is clean; the men are clean. No mixed dirt gets rubbed off on their towels. The bench hands have a shelf pivoted under their benches. A pail of clean water is placed on each shelf twice a day.

You don't see any junk shop business around that ranch. You don't find any cholera boxes either, or dark corners with four inches of sawdust, tobacco juice and dirty waste therein. No hunting for tools in such shops. When a man takes up a tool, he don't have to scrape it and then take it to the light to see whether it is a monkey wrench or a pair of blacksmith's tongs.

A nice clean chap will spend half an hour cleaning up a repair job. Let him alone. His head is level. That half-hour is well invested. He will get done two hours sooner and the job will be clean; he will be clean, and he don't lose another half-hour scraping tools and washing face and hands.

What nice tools the nice chap has got. They are always ready for use, and he always knows where they are. If he wants his scale, he don't have to overhaul 200 pounds of assorted museum on his bench. He keeps that scale in a little till in his tool-box. The corners are all square and sharp. "New one, is it?" No, sir! He has had that scale two years, and it is all there. He carries an old one in his pocket. He keeps the new one to set calipers by, and the old one he keeps to take the wear and tear—and to lend.

Fig. 1.

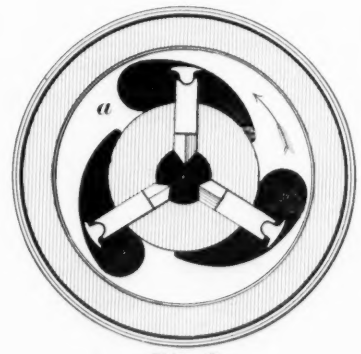


Fig. 2

Chappell's Chuck.

A Repairer's Emery Wheel.

While all repairers find that an emery wheel comes very handy, I will give you my plan of making one. Take an inch board, or thicker if so wanted; cut a wheel, say, 10 inches in diameter; cut four notches in the rims; then cut strips of No. $\frac{1}{2}$ emery cloth, the width of the wheel, and $\frac{1}{4}$ the distance around the wheel in length, allowing $\frac{1}{2}$-inch at each end to insert into the notches already cut in the wheel. After inserting them, wedge down tight; this can be replaced with new cloth as soon as worn out. See illustration.—*Sewing Machine News.*

Chappell's Chuck.

The chuck illustrated with this is the invention of Benj. F. Chappell, South Windham, Conn.

The case is of the usual barrel form, as shown in Fig. 1, the internal parts being held in place by a screw cap on the front end.

This case is provided at a point about midway between its central hole and periphery with a groove concentric with the periphery, and of a width and depth sufficient to receive the cam collar *a*, shown in the front end view, Fig. 2, which collar extends well rearward, being reduced in diameter at its rear end and having formed on the periphery of the reduced portion, gear teeth which, when in place in the case engage a screw, or worm, which is operated by a suitable wrench for the purpose of rotating the collar *a* within the case.

The front end of collar *a* is so cut away that a series of internal cams or inclined surfaces are formed corresponding in number to the jaws to be used.

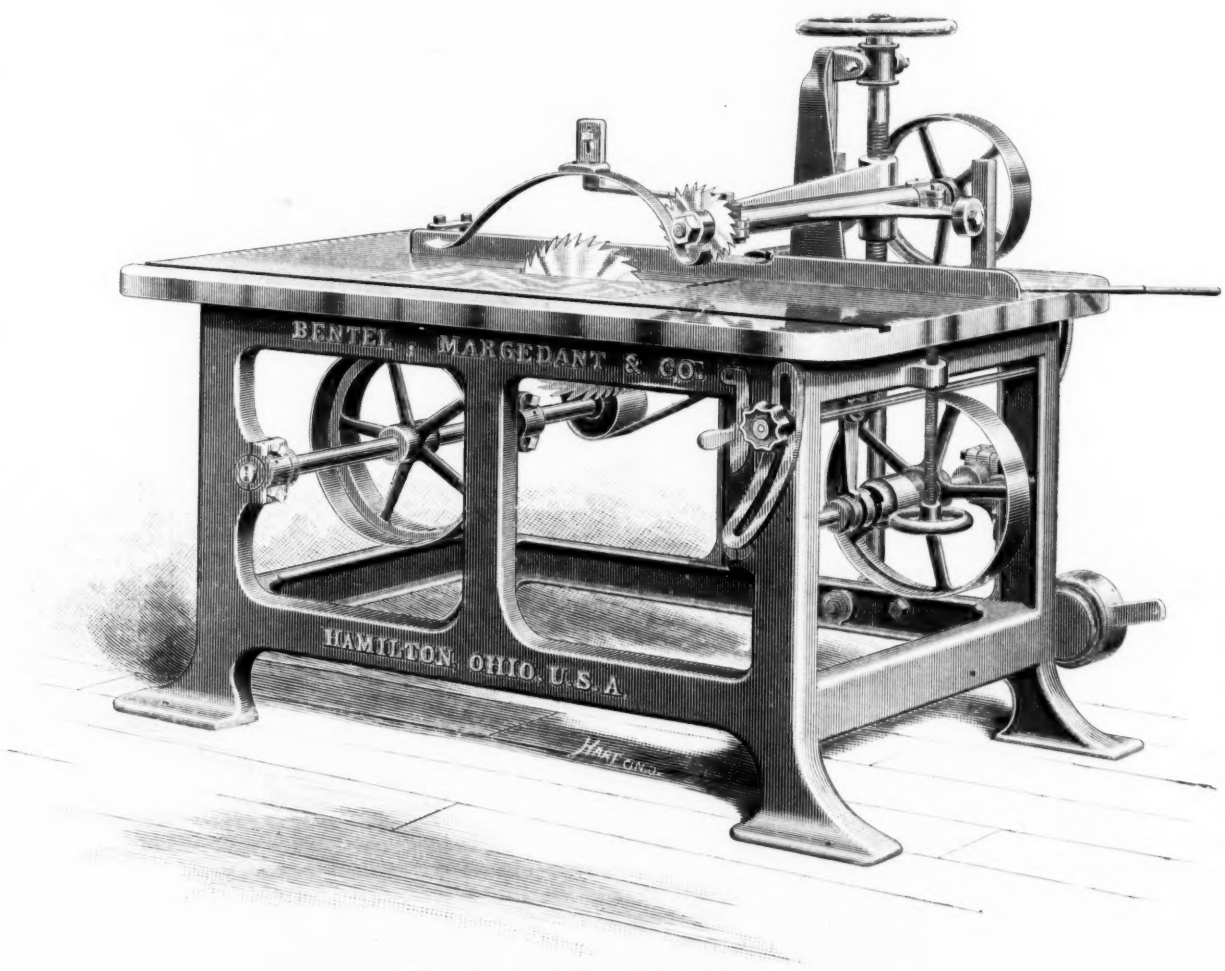
That portion of the case between the cam collar, and the central hole provided for the drill, is slotted radially to receive the jaws, which are preferably three in number. Between the outer edge of each jaw and its operating cam an anti-friction piece is interposed (see Fig. 2) which is adapted to rock slightly in its seat so that there shall be no tendency to cramp when forcing the jaws inward.

It will now be seen that as the collar *a* is caused to rotate in the chuck case, the cams will simultaneously engage their individual jaws, forcing the jaws towards their common center, grasping firmly whatever is placed between them.

The action of the traveling cam collar is identical with that of wedges driven in behind each jaw, forming a solid back which will not allow the jaws to work loose. Convenient and simple mechanism is provided to withdraw the jaws as the cams recede.

Paterson Locomotive Shops.

Locomotive building is one of the chief industries of Paterson, N. J., and it is decidedly dull at present. The Rogers Locomotive Works are best provided with orders, having received some recent contracts from the South. They are employing 650 men, or about one-third of their full force. Among other orders they are working to fill is one for several passenger engines for the West Shore railroad, and one for engines to go to Cuba. The Cook Locomotive Works report business dull, and the outlook far from promising. They have from 300 to 400 men at work, each 30 hours a week. They are building four locomotives of the Forney type for the Staten Island railroad; also two passenger engines for a new road in Florida. The Grant Locomotive Works are taking advantage of the dullness to improve their shops and tools. The front wall of the main erecting shop is being torn down. Two floors will be taken out, the building (50x120 feet) raised six feet, and a new floor put in. This will give more room between floors, and a better light. Old machines are to be thrown out and replaced with new ones. They will purchase a new quartering machine, a new tire boring machine, also lathes, planers, drills, and other tools. At present only twenty men are employed.



UNIVERSAL SELF-FEED RIP SAW.

Universal Self-Feed Rip Saw.

This machine is adapted for either power or hand feed, and for rip or cross-cut sawing and beveling. It is suited for use in planing mills, sash, door and blind, wagon and furniture factories, agricultural implement and car shops, or for general sawing.

The feed will raise or lower to admit material up to six inches in thickness, and is self-adjusting for unevenness of the lumber. By raising it high enough for the roller to pass the vertical bar shown on the right, on which it travels, the horizontal arm will swing off the table, leaving it free for hand, rip and cross-cut sawing, mitering and beveling. By means of the lever, shown in front near the corrugated hand-wheel, the feed can be started and stopped while the saw is in motion. The pressure of the feed roll can also be regulated for heavy or light, hard or soft lumber, or the feed may be lifted entirely off the material in an instant, while the saw is in motion. The feed has four changes of speed, viz.: 50, 65, 80 and 100 feet per minute. The path of the feed roll is in the line of the saw kerf, so there is no danger of marring the surface of planed material. The feed countershaft is driven from the saw mandrel, which increases or diminishes its speed proportionally with any change in the number of revolutions made by the saw. It also does away with an extra belt from the countershaft.

The saw mandrel is made of tool steel, with steadying rings in one journal, instead of grooves. It rests in a strong double webbed housing, which spans the frame on both sides. The journal boxes are planed and milled, carefully fitted, and filled with babbitt metal, carefully scraped to a true bearing. When so ordered, a mandrel of such a length, with all necessary collars, will be provided, that two or more saws may be used at once, from $\frac{1}{2}$ to 6 inches apart.

A spring shield is placed above the saw, which serves to hold the material firmly down, both before and behind, and also to prevent loose knots and splinters from flying back.

The machine is built with either a wooden table, consisting of joined strips of hard wood, or with an iron table, as shown in the cut. Both tables are five feet long by three feet wide, and fitted with a recessed slide in front of the saw, for the reception of a sliding rip-board or an adjustable sliding fence, for cross, miter and bevel cutting.

The hand-wheel and radial braces shown in front are for sustaining the table at different heights, thus giving free access to the journal boxes.

The fence is quickly set by the hand lever projecting over the table, from a position directly back of the saw, to sixteen inches or less between the fence and saw. An accurate scale cut in $\frac{1}{4}$-inch figures in the table, guides the operator in close and quick adjustment of the fence.

The tight and loose pulleys on the countershaft are of the differential pattern, the loose pulley being of smaller diameter than the tight.

These machines are made by Bentel, Margedant & Co., Hamilton, Ohio.

A correspondent from St. Joseph, Mo., sends us an account of an explosion in a boiler at that place by which three men were injured—one very seriously. The boilers were cold, and two of the injured men were working about the rear end of the boilers, and the third took a lantern and a can of alleged crude petroleum, went on top of one of the boilers and poured it in the boiler. He then lowered the lantern down in the boiler, when the gas exploded with the result mentioned, and a shaking of the buildings for two or three blocks around. The oil was used for preventing scale, and was not supposed to be dangerous, but an examination proved it to be highly so. This is not the first time we have chronicled explosions from the use of highly-inflammable or explosive coal oil, and we should recommend that it be tried, in small quantity, before taking any risks in its use.

Valve Gear History—An Immense Iron Works to be Erected in Italy.

Editor American Machinist:

In your issue of May 16th you printed a short notice concerning Mr. Charles Brown, of Oerlikon, near Zurich, Switzerland, which contains a few inaccuracies, which please to permit me to call your attention to.

What, in some instances, is called the Walschaert motion of valve gear is really the invention of Hensinger von Waldegg, or, to say the least, priority belongs to the latter. He designed the motion in 1849, and in 1851 an engine with this motion was sent to Liege, in Belgium, where it was employed at the dock works. The motion is well known in Belgium, and Walschaert, a Belgian engineer, had occasion to see this gear at Cockerill's, where the above engine was sent for boiler repairs. It was not until several years after 1851 that the motion became more generally known under the name of Walschaert. Your description of the gear is correct. One eccentric only is used to govern the principal motion of the valve, and the regulation of the lead is taken from the crosshead.

Mr. Brown's valve motion is essentially different. He employs no eccentrics or cranks whatever, and he has been the first one to take the whole valve motion from some point of the connecting rod between crosshead and crank-pin. I may have occasion to elucidate at some future time his most elegant and ingenious constructions, which, in one form or another, are destined to supersede the older forms of gears. Joy's, as well as others, are mere variations of Brown's original creative idea.

A short time ago the celebrated firm of Sir Wm. Armstrong, Mitchell & Co., in Newcastle-on-Tyne, entered into large contracts with the Italian Government for the supply of enormous quantities of material, and they decided to start extensive works at Pozzuoli, near Naples, for building guns of the heaviest caliber, torpedo boats, and ships of the largest types. The works will cover an area of about seventy-five acres, some six to seven millions of dollars will be expended, and some five thousand men will be employed! Mr. Brown, who always has been managing large concerns, and whose eminent qualities have given him one of the foremost places in the profession, has received the brilliant offer to take charge of these works, and he has accepted. He is already upon his new field of labor, and it will not be long before his genius will have won him new distinction.

OTTO GRUNINGER.

The students of the Stevens Institute of Hoboken, N. J., have issued their *Eccentric* for 1885. It has about 150 pages, and the cover presents a metallic appearance. It is illustrated with a number of choice cuts—some of them cuts at the faculty, and others cuts at vulnerable students. There are lists of students by classes, by societies and by clubs. Both prose and poetry sketches are lively and interesting. Copies may be obtained from the Board of Editors at the Institute.

Foreman Behan, of the shops at Michigan, City, Ind., will supersede Foreman Bruce, of the Michigan Central railroad shops at Jackson.

The forty-third meeting of the American Institute of Mining Engineers will be held at Chattanooga, Tenn., beginning Tuesday, May 1. The programme covers the week until Saturday. Among the papers announced to be read are the following:

The Manufacture of Steel Castings, by Pedro G. Salom, Thurlow, Pa.

The Flow of Air and Other Gases, by Fred. W. Gordon, Philadelphia, Pa.

The Relative Value of Coals to the Consumer, by H. M. Chance, Philadelphia, Pa.

Notes on American Blast Furnaces, by John Birkinbine, Philadelphia, Pa.

The Basic Bessemer Process, by Thomas Egleston, New York City.

Frank S. Brown, son of the general superintendent of the Michigan Central railroad, has gone to St. Thomas, Canada, to become assistant division superintendent of the Canada Southern.

Iron, of Philadelphia, blubbers over with "sympathy" for employers of labor who fail to make both ends meet, to the extent of a whole column broad gauge measure. It says: "There is plenty of sympathy for the laborer, but none for the proprietor. No one cares to look into his affairs, and apparently no one cares whether he is driven into bankruptcy or not. All sympathy and statistical care is bestowed upon the vote-possessing employe. This is not as it should be."

How much is maudlin sympathy worth to either employer or employe? It won't pay any expenses. Intelligent men, whether working for wages or employing others, severely deprecate the patronizing style adopted by some newspapers in treating the labor question. They do not beg for "sympathy" in cold type. *Iron* and other journals that evolve such appeals to sentiment waste their sweetness on the desert air.

Fogarty's Steam Trap.

The operation of this trap is as follows: The condensed steam accumulates until it meets and lifts the float to the position shown in the engraving, thus bringing the openings in the seats and valves opposite each other, thereby permitting the accumulated water to flow out freely; when the float lowers again by the outflow of the water, the valves are closed. This intermittent operation is automatic, and continues as long as condensed steam flows into the trap.

The openings in the valve seats are at considerable distance from the bottom of the trap, and are thus kept free from any sediment that may accumulate in the bottom; the blow-off cock in the lower part is for carrying away such sediment as may accumulate.

The valves, valve seats, beam and connecting rods are all of gun metal, and the pins of steel; all the working parts are made to interchange. The shell is made of cast-iron, arranged to bolt to the side of a beam or to any convenient place; this permits of the lower head being easily removed in case of necessity; all the working parts come out with the lower head to which they are attached, and are therefore reached without disturbing the trap or the steam connections.

The trap will work with steam at any variation of pressure, and has its valves sealed with water, so that they are not exposed to the direct action of steam; the water level is maintained, as shown, above the valve and seats.

The valves are balanced in every direction.

There will always be an empty space for water to empty into, as in no case will the water rise above the center of float.

James H. Fogarty, 97 Liberty Street, New York, is the manufacturer.

The Trenton Engines.

The Phœnix Iron Company, Trenton, N. J., have begun the systematic manufacture of three classes of steam engines, which they designate as class "A," "B" and "C," some of the particulars of which we gather from a very completely-illustrated catalogue recently issued. In the three classes the bed-plate is of substantially the same design, being cast in one piece with the pillow block and guides, the latter being bored for the cross-head. In all, the cylinders are cast with base to rest on the foundation. All the engines are automatic cut-off.

Class A is fitted with releasing valve gear, but only two valves are employed for admission, cut-off and exhaust, the exhaust being positive. These valves are circular in cross section, fit loosely upon the stem, and are perfectly balanced. The steam edges of the valve are in the form of a helix, and, in addition to a sliding or rectilinear motion, are given a circular motion; this tends to a quick port opening.

The valves slide together, but in their circular motion are independent of each other. They receive circular motion through vertical valve stems passing through the steam chest, the stems being operated from the eccentric. Dash-pots and pistons are provided at the lower end of the stems, and releasing gear, under control of the governor, at the upper end.

For admission the valves are rotated forward, and, when tripped by the releasing gear, return to their original position, cutting off steam. A parabolic fly-ball governor is employed, and the range of cut-off is from 0 to practically full stroke.

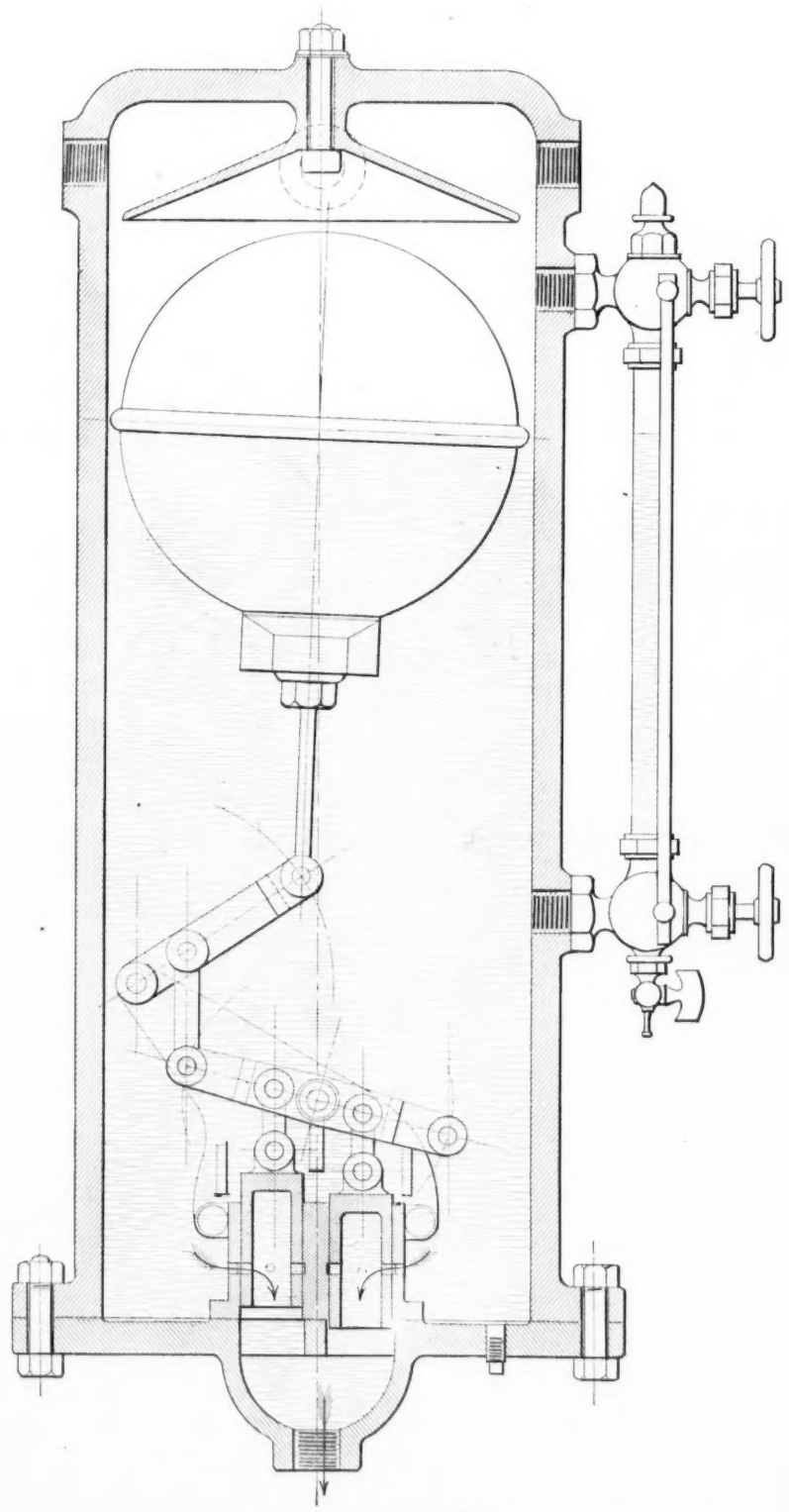
The difference between classes A and B is chiefly in the valve gear and governor. The valves are similar, except that in class B the ports, four to each valve, instead of being helical, extend in a direction longitudinally. These valves are rigidly attached to the stem, and have simultaneous rotary and sliding motion. The rotary motion admits and cuts off steam, and is under control of a centrifugal disk governor. The sliding motion takes care of the exhaust, and is from a separate eccentric. The eccentric that is controlled by the governor is moved across the shaft in such a way as to preserve constant lead, and the cut-off is from 0 to $\frac{3}{4}$ stroke.

Class C engine differs in its valves and valve motion from either of the others. Two valves are employed, which are of the Corliss type, double-ported. These valves are placed below the bore of the cylinder, and a wrist-plate is employed to give quick opening for admission, and to hold the exhaust open. These valves have positive motion—that is, they are not tripped. They are controlled for cut-off by a disk governor similar to the one used on class B.

Some of the dimensions adopted in the construction of these engines are: Diameter of crank-shaft = $\frac{1}{2}$ the bore of cylinder; diameter of crank-pin = $\frac{1}{4}$ the bore of cylinder; diameter of cross-head pin = diameter of cylinder divided by $5\frac{4}{10}$; length of main journals = $\frac{5}{8}$ up to full diameter of cylinder; length of crank-pin = $\frac{1}{4}$ the diameter of cylinder; length of cross-head pin = diameter of cylinder divided by $4\frac{8}{10}$.

The larger sizes are represented in class A, the medium in class B, and the smaller in class C. For class A, cylinders from 24″×48″ to 32″×60″, the piston speed recommended is 600 feet; for class B, cylinders from 10″×24″ to 22″×42″, piston speed, 600 feet; class C, cylinders from 9″×12″ to 12″×20″, piston speed from 300 to 600 feet.

It will be seen that only moderate rotative speed is employed, the relation of stroke to bore being such as to give fairly high piston speed.



FOGARTY'S STEAM TRAP.

Material for Locomotive Machinery.

The Western Railway Club of Chicago, a very intelligent organization of railroad men, at a meeting held some time ago discussed the best material for different parts of locomotives. G. W. Stevens, superintendent of motive power of the Lake Shore Railroad, said they used iron for most parts of the motion, but he was not wedded to iron, and thought steel was preferable in many instances. So far as he could make out, steel gives from 40 to 60 per cent. more wear than iron, besides being safer from breakage, owing to its greater tensile strength. It has been the practice of the road to use steel for crossheads, and there never has been a case yet where one of them has broken. Cast iron crossheads, on the other hand, have been a decided failure.

Mr. Allen Cook, master mechanic, Chicago & E. I. Railroad, had some experience with steel piston-rods, and did not find it satisfactory. For crossheads he found that steel answered better. He used cast iron rocker arms, and they gave good service.

Mr. Forsyth, C., B. & Q. Railroad, said the material for a crosshead depends a great deal upon the form of the crosshead. If you have the old four-bar guides, it is well to make the crosshead of steel; if you have two guides that are wide apart, the center of the crosshead can be made of wrought iron and the gibs of cast iron or brass; and if you use the Laird guide, the body of the crosshead had better be of steel and the sliding-block of cast iron. Respecting piston-rods, a locomotive piston-rod is subject to more severe service than any other part of the machine. The alternate thrust and pull for each revolution of the driver causes tensile and compressive strains. The factor of safety proper for the material to resist either of these stresses is only half that required when it is subjected to both. In addition to the matter of strength, the rod must possess sufficient rigidity not to bend when subject to the load of the initial pressure on the piston-head. The piston-rod has also a wearing surface on nearly the whole of its length. For these reasons it performs its functions under the most unfavorable conditions, and the best material suitable for these conditions should be used, regardless of cost. The elastic, tensile, and compressive strength of steel is nearly twice that of wrought iron, and if these qualities only were to determine the size of the rod, we could make a steel piston-rod half the diameter of an iron one; but when the diameter is less than one-twelfth the length, the tendency to bend or buckle, is greater than the tendency to stretch or crush. When the diameter is calculated for this, we find a steel piston-rod should be nine-tenths the diameter of an iron one. The strength and rigidity of steel being greater than iron, and having greater hardness and uniformity, it will wear longer, and therefore is the best material.

Mr. Edgerly, superintendent of motive power, Michigan Central Railroad, did not think piston-rods of either material ought to break if they were properly fitted. He would not take iron as a gift so long as steel could be got. They grind the crosshead and piston-head, and take as much care as possible in making the fits of the key-ways, and he never saw one that broke. They use wrought iron rockers. He could see no advantage in making them of steel, and he thought cast iron was a mistake.

Under the heading of "Facts Whittled Down," we find the following item in *Fiber and Fabric:*

"Never put a postage stamp in an envelope loose. More than half of them are lost that are enclosed in that way."

It strikes us that it would not take much more whittling to cut all the fact out of this statement. Postage stamps are usually enclosed loose in letters and the losses are but a very small part of the number thus transmitted.

Dangerous Car Wheels.

At a recent meeting of the New York Car Builders' Club, the subject of cast-iron car wheels was under discussion. Speaking on the subject, Mr. Wilder, of the Erie Railway, said that it had got so that many western roads would not have certain brands of Eastern wheels put under their cars to replace bad ones. The Erie road had an accurate wheel record for the year 1884, giving wheels in service and the number that had failed from breaking or cracking. Out of 250,000 in service, 3,393 were removed for being cracked or broken. Of these, 2,121 had cracked plates, 490 cracked tread, 248 broken tread, 99 cracked hub, and 116 broken flange. Of 40,000 which they had of one make the proportion removed was 1 in every 312. Of 43,000 of another make, 150 had broken, or 1 in 285. Of 43,000 of still another make, 197 had broken, or 1 in every 217. Of 21,000 of another make, 124 had been removed, or 1 in 117. Of 40,000 of still another make, 156 had given out, or 1 in 88. To offset this, they had many other varieties of makes which they received under cars they contracted for. These they did not consider their regular wheels. Their record was very bad. Out of 1,754 of a certain make, 379 had been removed, or 1 in 4. Of 436 by another maker, 118 had to be removed, or 1 in 4. Of 700 of another, 92, or 1 in 8, had been taken out. Of 1,500 of a certain make, 163, or 1 in 9, had given out, etc. In the best record of low-priced wheels they had, 1 in 72 had given out, and in the best record of the good (their regular) makers, the proportion was 1 in 312, which was a good

average. He thought that his road could not afford to buy cheap wheels. He would protest against the use of such.

We presume the car wheels complained of were put in last year, when the Erie management was suffering from one of its blind retrenchment fits.

Not a Fish Story.

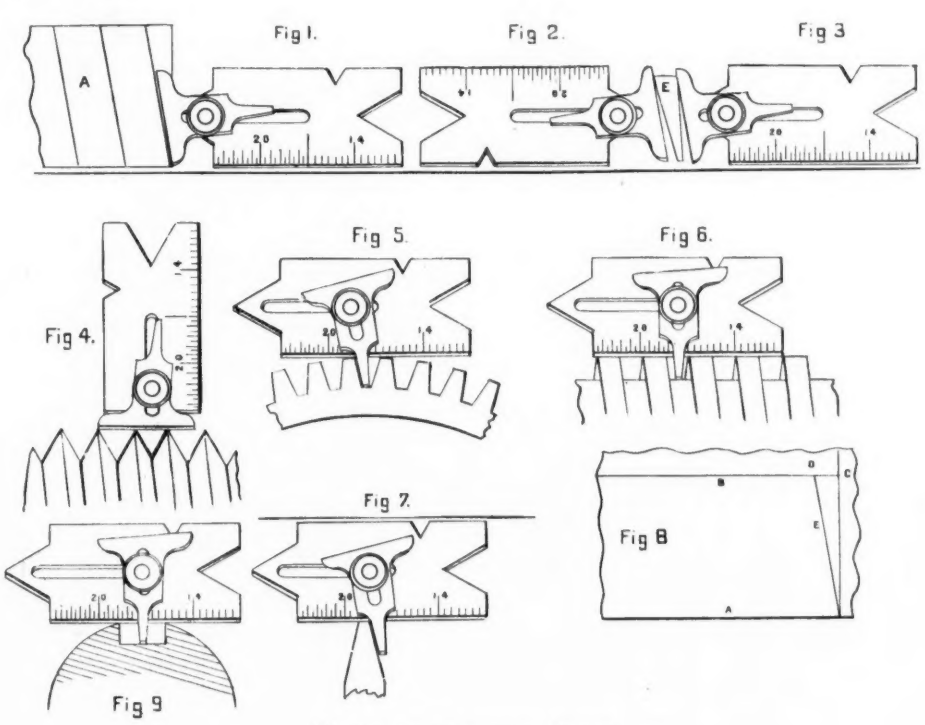
This is not a fish story because it is about an eel. At Van Deusen's laundry, Troy, N. Y., a recent stoppage of their water supply revealed an eel, 2 inches diameter and 31 inches long, which had passed tail foremost into a 2-inch pipe through a Ludlow valve and two elbows, and was alive when found.

F. H. R.

A Curious Wheel Accident.

The *Railway Review* published lately the details of a very remarkable wheel accident that happened on the Chicago, Pittsburgh & St. Louis Railroad. A freight train having 32 cars was running East at ordinary speed when one of the last wheels on the ninth car of the train broke. A piece came out of the tread of the wheel and that pair of wheels dropped off the rail. The train men were on top of the cars part of the way, but the train ran nine miles with the broken wheel pounding over the ties, but none of the other wheels left the rails. So far as the train was concerned no damage to speak of was done, but the track suffered severely. At every revolution the broken wheel kept hitting the rails heavy blows, and it broke 47 rails completely through and broke pieces out of the flange of a great many more. So serious was the damage that the superintendent recommended that new rails should be purchased to replace one side of the whole eight miles. It seems curious that a cast iron wheel should do so much damage to heavy steel rails without hammering itself to pieces. Yet the wheel came out of the fray little worse than it was when it dropped off the first rail.

It is announced that Samual H. Edgerly, of Marshall, Mich., resigned May 1, as master mechanic of the Michigan Central locomotive department, to become a Virginia planter on a large estate near Richmond.



WYKE'S SCREW CUTTING GAUGE.

Wyke's Screw-Cutting Gauge.

These gauges are made by J. Wyke & Co., East Boston, Mass. The engravings, with the following description, will explain the uses of the tool: To get the rake of thread of any pitch whatever, take a piece of sheet metal (or other material) Fig. 8, with one edge *A* true. Then lay off a line *B*, the same distance from the edge *A*, as the diameter of the screw to be cut. Then draw line *C* at right angle with edge *A*. Then from line *C*, on line *B*, measure off half the pitch *D*, and draw line *E*, which will be the angle or rake required for the tool. Set the gauge as shown in Fig. 1.

When the gauge is set to the line as shown in Fig. 1, it is then set to use when making tool, and is applied to both sides as shown in Figures 2 and 3. *E* represents the tool with clearance allowed. When the gauge is set to the rake of any right hand thread, by simply turning it over on the other edge it becomes set for left hand.

When cutting V-threads, the gauge can be used for grinding angle of tool (60°) and setting the tool square on rest; also for depth and for testing accuracy of thread. When testing accuracy of thread, set the gauge down in the thread as shown in Fig. 4. Then reverse the gauge, and if the thread is not correct it will be seen at once. This can be done before the screw is quite finished, thus giving time to finish correctly.

When cutting bastard threads, the gauge can be used for depth, angle of thread, and setting tool correctly on rest as shown in Figures 5 and 7. (The line represents the bar in the lathe, and the tool is supposed to be in the rest.) Also, for testing whether the thread be perpendicular to the axis of the screw.

When cutting worms to suit gears, set gauge as shown in Fig. 5. It is then set for depth of thread, also for testing thread and setting tool correctly on rest.

When cutting square threads, set the gauge to half the pitch by scale, and you have the depth required as shown in Fig. 6.

The gauge can be used for taking all depths of the Franklin Institute Standard threads, also standard worm threads from the regular standard gauges.

It can be used for getting equal clearance when making cutting-off tools, and as a depth gauge when cutting gears, drilling and planing out key seats, etc., as shown in Fig. 9; also as a depth and angle gauge for many purposes.

These gauges are made in two sizes. No. 1 has a graduated scale two inches long, and can be used for all threads up to three-quarter inch pitch. No. 2 has a graduated scale three inches long, and can be used for all pitches from half-inch to two and one-half inch pitch, or for other purposes, as mentioned.

These gauges are made of the best steel, and are hardened and well-finished.

We find the following in a recent issue of the London *Railway Review*:

The announcement has been made that the Amalgamated Society of Engineers have recommended the workmen on a strike at Sunderland to accept work if they can obtain it (we presume on the master's terms). This ends the longest strike on record. It has been going on for over a year and a-half, and no good result has been obtained. The strike was on account of the desire of the men to limit the number of apprentices to the trade, the object being to prevent an excessive supply of labor in this occupation, and thus to keep up the wages of the workmen to a proper standard. There cannot be two opinions about it being desirable that fair rates of wages should be paid, and no one is the gainer by an excessive supply of labor being in the market; but it has been the custom in this country that this question should be left for settlement to the law of supply and demand. It is, however, questionable whether the demand of the political economist employer is logically put into practice when dealing with his own business. Every one knows that, in many instances, arrangements have been made to restrict the output and manufacture of articles of commerce so that fair and remunerative prices may be obtained. If this is right on one side, there ought to be no objection on the other, especially with those who persist in treating labor as a commodity and place a value upon it in accordance with the supply and demand. There are several trades in this country that have made arrangements and rules with the employers on this matter, and no harm has been done. The relations of employer and employed are in a very bad state when a question of this character cannot be mutually arranged without resort to strikes, which can only end in the ruin, or at least great loss, to one or both parties. The spirit displayed by the engineers of Sunderland has been a noble one. They have suffered much privation for a long time on behalf of a principle which they believed to be right, and in admitting that they are defeated they suffer no loss of prestige.

Andrew Saunders.

Andrew Saunders, one of the brothers of the firm of D. Saunders' Sons, who died at Yonkers, N. Y., April 26, at the early age of forty-two, was a mechanic and inventor of undoubted ability, who in a quiet and unobtrusive way did work of lasting value. Mr. Saunders was born in Dundee, Scotland, but his father came to this country when Andrew was a mere lad, and soon started in the machine business at Yonkers. At the death of the father, the sons continued the business under the present firm name. They entered extensively into the manufacture of machinery for threading pipe and fittings, which at that time was of a crude description. For systematizing this class of machinery and its manufacture, and for many valuable improvements in it, not only the firm, but all who use such machinery or its products, are largely indebted to Andrew Saunders.

Mr. Saunders was of remarkably retiring disposition, and, instead of seeking, always avoided notoriety. But those who sought his advice or assistance in relation to mechanical inventions, seldom went away unaided, and were struck with his quick perceptive faculties and mechanical insight. To his faculty of quickly comprehending mechanical problems he united untiring perseverance in working out his conceptions, which made success in what he undertook almost certain.

Cast Iron Car Wheels.

When Bessemer steel rails were first made, an important portion of the mechanical world believed that good iron was better suited for rail making than any steel made by the pneumatic process. That being the case, it has often been a matter of surprise how rapidly steel rails pushed iron rails out of the market. The cause of the sudden change was that iron makers got so anxious to make fortunes rapidly, that they got supplying iron rails of such scandalously inferior quality that the interests of common safety demanded a change to a better article, and railroad managers, despairing of improving the quality of the iron, became purchasers of steel. The iron masters were helpless to stop the tide when it began ebbing away with their business.

Another important business of railroad supply is in imminent danger of going as the iron rail trade went. Of late years paper and steel plate car wheels have been coming to some extent into use, but at the present day the recognized car wheel of the American railroad is made of cast iron with chilled tread. When this wheel is properly made of suitable iron it gives very satisfactory results, both for wear and for safety. But our inferior cast iron wheel is a peculiarly unsatisfactory and dangerous article; and there is crying danger that cast iron, made without care or skill and of bad material, will be the means of giving all kinds of cast iron wheels as bad a name as all kinds of iron rails received before they were frozen out of the market. A statement was recently made at a car builders' meeting that 25 per cent. of the cast iron wheels supplied by two makers had failed in service, and those of several other makers had done little better work. This is a most dangerous condition of affairs, and a railroad company purchasing wheels of such a character is recklessly jeopardizing the lives of all who are connected with the trains where the wheels are in service. The railroad manager who encourages inferior work by buying bad, cheap wheels, is quite as much to blame as the wheel maker for the damage and expense resulting from a wreck caused by a broken wheel; but the development of prejudice against all cast iron wheels that grows from the evil record of a few makers will eventually make the whole trade suffer loss of business, and the manager who patronized the shoddy maker will coolly order paper or steel plated wheels, because iron was not reliable. So long as cheap cast iron wheels are put on the market, they will be bought by those who follow the blind policy of meeting immediate wants in the cheapest possible way. Every wheel of this kind sold is a blow struck at the trade. Shoddy wheel making is not confined to one or two firms. There is a tendency to extend the business rather than to restrict it, although the outcome is certain to bring disaster upon the whole business.

People will begin to have more confidence in the Government Bureau of Engraving and Printing, at Washington, which has generally been considered in the light of an expensive necessity. Recently the Bureau entered the lists in bids for furnishing postage stamps for the Post Office department, and was the lowest bidder amongst several competitors.

On the North London (England) tramways the cars are run alternately with steam power and by horses. That the public favor the use of steam is shown by the fact that many more passengers ride on the cars operated by steam than on those drawn by horses.

In a recent interview, Mr. Lothian Bell, the eminent English metallurgist, gave particulars respecting investigations he had made regarding the relative cost of producing manufactured iron in America and in Britain. Mr. Bell is an enthusiastic free trader, and no one understands better than he what the result would be of opening American ports to free entry of British-made iron. Mr. Bell said that he had studied the question of cost when visiting the United States, and more recently he had been favored by American friends with tabular statements of the actual number of men employed at the respective furnaces, and the average wages paid. By comparing these with the average practice in good English establishments, he found that in the United States one-sixth more men for each furnace are required for producing less than half the quantity of iron; also that the price of labor in America is about double what it is in England.

The importance of the use of high-pressure steam cannot be too constantly urged upon engineers and manufacturers, and that the employment of low-pressure steam in engines is extremely wasteful; yet, clear as this is or should be to all intelligent engineers and steam users, they do not recognize the truth. One may often hear an engineer boasting, "I have got an extremely good engine; it's

'boss;' she will drive the whole load with forty pounds of steam," never reflecting that when he is using steam at only forty pounds above atmospheric pressure, in a non-condensing (high-pressure) engine, one-third of the whole of the fuel is consumed in getting the steam up to the atmospheric pressure; while, if he were to use the steam at one hundred and twenty-five pounds to the square inch, only one-ninth of the fuel would be so wasted.—*W. Barnet Le Van, in the Journal of the Franklin Institute.*

LETTERS FROM PRACTICAL MEN.

Pitch of Worm Gears.

Editor American Machinist:

Your correspondent, Gordon, has found a real, first-class nuisance that has bothered every full-grown machinist living, but has not, to my knowledge, appeared in print before.

The matter of pitch, so far as spur and bevel gears are concerned, is very well settled, and the diametral pitch, with its corresponding addendum, is in universal use for cut gears. But on worm gears we are almost forced to stick to the old-fashioned circular pitch, for the reason that the worm gear must have the same pitch as its worm, which latter is turned in a lathe with the change gears used for ordinary screws, and, like a screw, measures its pitch by so many whole turns or threads per inch.

If the worm is turned on that system, the gear must be cut on the circular pitch system to correspond, and all the defects of that system must be put up with.

The only escape is to use the diametral pitch system, and shape the gear-blank to it, having the calculated outside diameter at the throat or smallest diameter of the concave face, and then to force the worm into the same system by turning it with an irregular or fractional number of threads per inch, by change gears adapted to that purpose.

The number of threads per inch, to correspond to any diametral pitch p, is equal to p divided by the ratio 3.1416, and the change gears used must be figured for that number.

In general terms, the stud gear is to the screw gear as 3.14 times the number of threads to the inch on the leading screw is to the diametral pitch of the worm to be cut.

If the leading screw is 6 to the inch, and the worm to be cut is 8 diametral pitch, the change gears must be:

$$\frac{\text{Stud}}{\text{screw}} = \frac{3.14 \times 6}{8} = \frac{18.84}{8} = \frac{59}{25}$$

very nearly, or perhaps near enough to the even numbers $\frac{60}{24}$, for the bearing of the worm in the gear is generally so short that it is not worth while to figure the change gears very close to the truth.

It is, however, quite useless to talk about an improved method, for the old system has got a grip that it will be hard to shake off. All the worm tool gauges, hobs, change gears and cutters are made that way, all the draftsmen and engineers work and plan that way, and worm gears must be made that way for years until the old fogies are all dead, and the powers that control such matters consent to set a better example.

On the circular pitch system the parts of a worm gear can be calculated by the following rules:

The pitch diameter is equal to the circular pitch, multiplied by the number of teeth, and divided by the number 3.1416.

The throat diameter, or smallest diameter of the concave face, is .6366, or about five-eighths of the circular pitch larger than the pitch diameter.

The number of teeth is equal to 3.1416 times the pitch diameter, divided by the circular pitch.

For example, a 10-inch gear of $\frac{1}{4}$-inch pitch has a throat diameter of $10 + \frac{5}{8} \times \frac{1}{4} = 10\frac{5}{32}$ inches, and $\frac{10 \times 3.1416}{.25} = 125.66$ teeth. A gear with 96 teeth of $\frac{1}{3}$-inch pitch has a pitch diameter of $\frac{96}{3 \times 3.1416} = 10.19$ inches, and a throat diameter of $10.19 + \frac{5}{8} \times \frac{1}{3} = 10.21$ inches.

The depth of the worm tooth is .6866 times the circular pitch, or $\frac{2}{3}$ is near enough, and the angle of the tool is 29°.

The system is clumsy in the extreme, for if you adopt a convenient pitch diameter, the number of teeth will be fractional, and a whole number of teeth will give a clumsy fractional diameter, but this clumsiness must be borne with, unless it is thought to be worth while to fit up for diametral pitches.

Boston, Mass. GEO. B. GRANT.

Improved Method of Making Hay Rope

Editor American Machinist:

No one, only those who have practiced making hay rope for foundry purposes, can know how provoking it is to try to make a good firm rope $\frac{1}{2}$" to 1" diameter, and long enough to be serviceable, out of hay that is unfit for the purpose. After it has twisted in two or pulled apart a few times, I know of nothing that will cause a foundry man to lose his religion quicker, and indulge in language that is neither forcible nor elegant, unless it is when a moulder is closing a cope on and has "a drop out" at a time when the blast ought to be on.

In some sections of the country, good long hay can be procured, and it is no trouble to make ropes of lengths suitable for the work they are to be used on. In the South, it is not very often hay of a reasonable length can be obtained. Most of the hay used in the South is shipped from the North in small bales, and it is so short it is a difficult matter to make a rope of any reasonable length out of it.

The writer, in the AMERICAN MACHINIST, November 22d, 1884, illustrated and gave a description of making a core 10′ long and 36" diameter, to be suspended in the mould. Around the bottom of these cores, I stated "we used old second-handed rope, as it stood the pressure better than hay rope." This rope we buy second-handed from the steamboats here. Some time ago we bought a large lot at a United States Government auction sale here of second-hand goods, at a very low figure. They are three strand manilla hawsers, and when the strands are separated they are the right size for use. However, in the last lot we bought, there were several extra large ropes, and, after separating the strands, we found they were too large for any core we could use them on, and leave loam enough over the rope to be safe.

Thinking we might find use for the twine of which the rope was made, we cut these extra large strands into pieces, and had two small boys unwind them and make balls of twine about 8" in diameter, tying the ends together as they rolled it into balls. We soon had a large stack of them at less than one eighth of the price new twine would have cost.

A short time after these balls of twine had been made, we had occasion to make a lot of hay rope for cores 30" and 36" diameter. In making these ropes, we endeavor to make them as long as possible to save the time and expense of nailing or fastening the ends together when we wind them on the barrel. We bought the best hay we could procure in this market, and put an experienced man to work making the rope.

In a short time he came in the shop and complained he could not make a good hard rope out of that hay. "It's so short I can't spin it 25 feet long without it twisting in two or pulling apart two or three times." We thought ourselves of the balls of twine, and placing one of them on the ground behind the man, and passing the end of it under his arm, fastened it to the hook at the end of the crank held by the boy. The boy started back turning the crank, and we began to spin the hay on to the twine, and we found we had no trouble to make a rope uniform and firm 75 feet long. Since then we have made a large number of them, from 60 feet to 75 feet long, and we have not had one of them twist or pull in two, and they can be drawn on the core barrel as tight as any one wishes to wind them without danger of breaking.

Several foundrymen, to whom I have mentioned this (to me) new feature in making hay rope have tried it, and say they are well pleased with the plan. We make hay rope with a machine and with the hand crank, and for a good solid uniform rope we prefer the hand crank.

ROBERT E. MASTERS.

Casting Rolls on a Shaft.

Editor American Machinist:

I notice an article in your paper of May 9th, from our friend Robert E. Masters, in regard to casting wrought shafts in cast rolls, and get them solid and free from vibration. He recommends cutting a coarse thread on the part where the cast-iron will strike the shaft in the mould, and painting the part with red lead. Will not such a shaft fastened in the manner above mentioned have a tendency to screw itself out of the casting when great power is applied to it? And the less of foreign substance you apply to the shaft in the way of paint, the better you will be off, as the cast iron shrinking on to the wrought iron wants to hug it as tight as possible. We have had some experience in casting heavy rolls on wrought shafts. We make a machine for crushing seggars; the rolls are 30" long, 22" diam., 3" thick on face and 4" on the ends, and are cast hollow. A $3\frac{1}{2}$" shaft is cast in them. We have no trouble in getting them solid—in fact they are literally welded together. We fit the keys into the shafts the proper distance apart. We heat the shafts to a dark red, and don't put them in the mould until we are just ready to pour them. They all shrink near alike, the cast iron the most as it is the hottest.

Mr. Masters speaks of casting rolls solid. We would not recommend this unless they are small in diameter. When cast with a core they are apt to be more solid in the casting, have a better face on them, and the shrinkage in the iron is less.

In regard to James F. Hobart's article about Bill's trouble with his compression clutch on his countershaft, we can feel for him. We have been there ourselves. We don't have any more of them now, having taken them all off. When we move the shifter now, we know the lathe is going to stop.

Some few years ago we saw wherein a patent had been granted to a party for pasting a small thread in the end of an envelope, allowing the end to stick out about $\frac{1}{4}$ of an inch. By pulling out the thread it cut open the end. This thing would certainly be very useful, as every one knows the trouble of opening envelopes, and running the risk sometimes of tearing a check that might be inside. This never came into use. Can any of your numerous readers tell why?

BENJ. F. HETHERINGTON.

Indianapolis, Ind.

Most Economical Point of Cut-Off.

Editor American Machinist:

I notice considerable said in the AMERICAN MACHINIST lately as to the most economical point of cutting-off. In the August 6, 1881, number of the AMERICAN MACHINIST is a clear and complete description of the most economical point, when fuel alone is considered, and also when the cost of plant and attendance is taken into account, with chart to determine the cost for each point of cut-off, by Alfred R. Wolff, M. E., and James E. Denton, M. E.

Waterbury, Conn. W. E. CRANE.

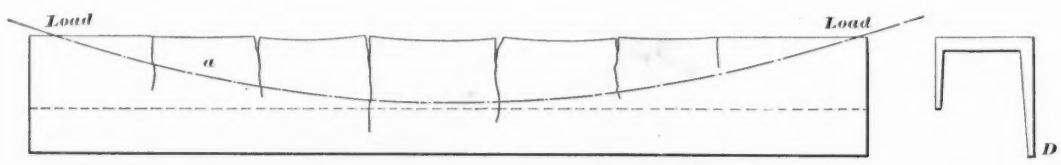


DIAGRAM SHOWING SHRINKAGE OF CASTINGS.

Shrinkage of Castings.

Editor American Machinist:

It is rather late to make a reply to criticism in your issue of Feb. 7, by Mr. George E. Stauffer, on my article of January 24, yet I wish to make a few remarks on the subject. Mr. Stauffer does not think that casting would have been straight had the pattern been made equal in thickness, and that I am in doubt about the result, because I did not use positive language.

If Mr. S. had a casting to make of a similar nature to that one described, and according to his suggestion, a load was placed at each end, I hardly think he could express himself positively about its shape until it had cooled. As I understand it, castings shrink with irresistible force, and as in our case, such force has a tendency to produce a crooked casting, and in the attempt to keep a casting straight, by preventing it from shrinking in its own natural way, it would be liable to crack, as in the cut.

I do not mean to say, however, that such would be the result in every case, as a good many castings of fine appearance may be made in that way; but from the fact that in the metal constituting upper portion of casting, a tendency exists to separate, owing to weights on ends, there would be a strain on that casting and metal, say above dotted line, *a*, would be more porous or less dense than that below, thus decreasing its strength.

The same conditions, it may be said, present themselves in a tapered casting, only from an opposite direction. There being less metal at *D*, it may crack while the top is finishing shrinking.

On the other hand, if the pattern was to be made convex, I do not think Mr. S. could, by exercising his judgment, positively state the precise amount of curve it should have for a given length to produce the desired result.

Hence, it is obvious why I should prefer giving a pattern for that class of castings as little taper as possible, as I then think we would (to borrow Mr. James F. Hobart's expression) be more liable to "hit the happy medium."

WILLIAM HULTGRAN.

Chicago, Ill.

Cooling Hot Bearings.

Editor American Machinist:

I would say for the benefit of N. J. R., Denver, Col., that if the heating he speaks of does not arise from excessive weight, or some cause beyond the reach of lubricants, a mixture of sulphur, salt, black lead and tallow, equal parts, by weight, of each, except the sulphur, of which one half or more, will cool his bearings and keep them cool. Melt the tallow and stir in the other ingredients; use cold, if there is a chance to apply.

Bridgeton, N. J. B. F. T.

Improved Oil Holes for Locomotive Motion.

Editor American Machinist:

A great deal of trouble has been experienced in the past by engineers on account of the poor oiling devices—or, rather, lack of devices—on locomotives. The small working parts—the link gear especially—are seldom, if ever, provided with anything but a small oil hole, often only $\frac{3}{16}$ inch size and $\frac{1}{2}$ inch deep. This only holds a little oil to start with, and the first movement of the parts, especially if there be any lost motion, throws out all the oil not adhering to the pin and sides of the oil hole. A great many accidents—cut, broken and burned eccentric pins, have come to my notice of late, to say nothing of vexatious delays to important trains. These pins, while not subject to the friction of a rotating part, are made to stand, beside the friction of their oscillating motion, continuous and heavy shocks, increasing as the parts become worn or the valves cut or imperfectly lubricated. The oil holes in the link lugs are the general oiling provisions; the first half mile uses this up, excepting a slight film, and the first pile of cinders or ashes the engine runs over, or

dust and sand stirred up, dries this up and furnishes a first-class cutting ingredient. I would propose that these holes be drilled *inside* the link through to the pin hole in the lug, the lower one at angle enough to come even with top of link block when in full back gear. These holes would be just as easy to oil and clean out dirt from as the old ones, and when the top of block is well oiled, as it always is, and the reverse lever thrown from full forward to back gear once or twice, these pins would be oiled well, and in the ordinary day's run would need no attention. Small V oil ways should be provided for the lower hole, so that the oil that worked by the block would be conducted to that pin, and thus do double duty. Small cups should be provided for the lower end of link hangers, as they are often out of sight and hard to get at on account of pumps on eight-wheeled engines, or driving brakes on consolidated engines. This plan has the advantage of costing no more than the old plan, possessing all of its advantages and none of its disadvantages. I have never seen it tried, but have often wished I was master mechanic just long enough to put it on the engine I run.

J. A. HILL.

Hydraulic Pressure Boiler Tests.

Editor American Machinist:

Mr. W. H. Odell writes that I failed to answer the most interesting portion of his inquiry, viz.: What object was gained by the test? The object was to test the workmanship, and have the boilers tight before leaving the works.

The material had been tested by the United States inspectors in the manner prescribed by law. I agree with Mr. Odell that too much hydraulic test commences when the pressure exceeds the limit of elasticity of the metal the boiler is made of; but I do not agree with him when he writes that a test piece cut from a sheet is but a poor approximation of what strain the metal will stand when worked into a boiler shell. If we make a boiler material 40,000 pounds tensile strength, and one of 70,000 pounds tensile strength, the workmanship being the same, is it reasonable to say that the former would be as safe or as strong as the latter? If we take steel of 70,000 pounds tensile strength, and allow that 5,000 pounds is all it should be subjected to (which is about fourteen times less than its actual strength), we would have for a section $\frac{85}{100}$" thick and 1" wide 1,250 pounds, which it would stand with the above factor of safety. We will reduce this 50 per cent. for drilling or punching the rivet holes. This reduction is more than the law calls for, and brings us down to 625 pounds. In order to be on the safe side, we will further reduce this 50 per cent. more, which will let us down to 312½ pounds—nearly as low as we tested the Eufaula boilers. I fail to understand why it should be inferred that boilers of that size, and made of that quality of material, will not stand a pressure of 300 pounds per square inch surface without injury at the time of testing. If there is any reasonable system of figuring that will show that boilers of that size are strained by the above pressure, I want to find it out as soon as possible.

In reference to the tests I have made, they may not be as scientific as experts would demand, but as science and practice are seldom possessed by the same individual, and as I make no pretensions to the former I will confine myself to the latter. One of the tests was on a boiler 16′ long 48″ diam., shell, steel, 70,000 tensile strength, $\frac{85}{100}$" thick. The boiler was made of five rings, each ring one sheet; longitudinal seams double riveted, rivets driven hot. We procured about 20 feet of No. 16 steel wire, formed a loop on each end, passed the wire around the center of middle ring of boiler, allowing the ends of wire to hang down. On each side of the boiler we attached a 25-pound weight to each end of wire to draw it taut around boiler; we made a mark with a flat chisel on top of boiler. We will call this mark No. 1. We removed the wire and introduced water to test boiler, temperature 180 degrees. When the boiler was filled we passed the wire around again, and made mark No. 2. We found the boiler had an increased circumference of $\frac{12}{100}$". We removed the wire and started test injector, and ran the pressure up to 325 pounds per square inch, and passed the wire around again while the pressure was on, and made mark No. 3. We found $\frac{8}{100}$" added to circumference. We then let the pressure off and tested with wire. Mark No. 2 corresponded exactly. Then we let the water out of boiler. The next morning when the boiler was cold we tested with wire again, the result being that mark No. 1, was the same as at commencement of test.

If this test of 325 pounds strained the boiler, will some of your readers inform me the cause, and at what point the boiler was strained? I am of the opinion the boiler was not strained, as no elongation or permanent set had taken place, consequently the elasticity could not have been injured.

We had to place a steam drum on this boiler after it was set in its working position. The piece we cut out for the drum was tested, and we found that the tensile strength was fully up to the record of the test piece cut from the same sheet before the boiler was made.

J. E. JERROLD.

Milwaukee, Wis.

Air Brake Question.

Editor American Machinist:

In a recent issue Mr. C. Beach asks if a locomotive air pump will compress air to a greater pressure than the steam pressure which drives, if the cylinders be the same? If the pump is in good order and the pipe connections of the reservoir are tight, it will do it. I have seen engine 405 on the Philadelphia & Reading Railroad with 80 pounds of steam have 90 pounds of air. If, now, Mr. Beach will set the pop on the reservoir to blow off at 120 pounds, and the pump and connections are in good order, he can compress air up to that tension with 95 pounds of steam.

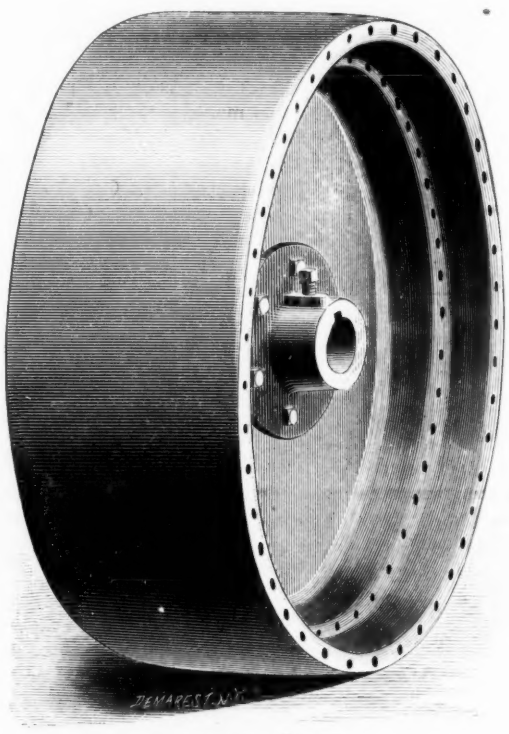
I have seen another locomotive carry 110 pounds of steam that could not compress air above 65 pounds, because the pipes connected with the reservoir were leaky.

I wish to ask some of your readers interested in the air brake whether a locomotive with 40 pounds of air can release brakes applied with 90 pounds of air? D. BEATTY.

[Our correspondent is evidently laboring under a mistake. Air cannot be compressed above the pressure of the steam working the pump, unless the area of the steam piston is greater than that which forces the air. In some of the air pumps, the steam piston is 8 inches diameter and the air piston 7 inches diameter. In this case, of course, the pump can compress air above steam pressure. When the areas of the pistons are equal, it would be just as well to expect that a weight of 80 pounds put in an even-balanced scale would weigh down 90 pounds in the other pan, as to suppose that 80 pounds pressing against each inch of a piston head would produce a tension of 90 pounds through moving another head of the same size. The question of releasing brakes with a pressure below that which is in the auxiliary reservoir is of the same kind. A great many men get deceived with air brakes through gauges being out of order.]

The American Paper Pulley.

The engravings represent two forms of this pulley, which is made in all ordinary diameters and width of face, with single or double arms or continuous web center. The material is uncalendered strawboard, cemented and pressed into disks under heavy hydraulic pressure, something as in the manufacture of paper car wheels. This is strengthened by hickory dowels, forced to place by hydraulic pressure. Finally the rough pulley is turned inside and outside on dead centers, insuring truth and balance.



PAPER DISK PULLEY.

PAPER PULLEY WITH IRON ARMS.

As put together, the traction comes on the end grain of the paper. Strawboard contains silica in a finely comminuted state. These particles are presented to the belt on the surface of the pulley, engaging with it in driving. By use, the surface, it is said, does not become glazed or polished, but always presents substantially the same points of contact for the belt.

We are informed that in experiments made between these pulleys and iron pulleys, it was found that the transmission with equal belt tension was four to one in favor of the paper pulley; or that for equal transmission the tension need only be but one-quarter as much, or for equal tension the width need only be one-quarter as great. The experiments to which reference is had are also said to demonstrate that a 24″ paper pulley is equal to a 48″ iron pulley, face and revolutions being equal; also that a contact of 90° on a 24″ paper pulley was equal to 180° on a 36″ iron pulley. From this it is concluded that it is entirely practicable to reduce the diameter and face 25 per cent. when paper pulleys are used; thus a paper pulley, 18″ diameter and 6″ face, may be used in place of an iron pulley 24″ diameter and 8″ face.

So far as weight is concerned, taking the pulleys size for size, the paper pulley will weigh about half as much as an iron pulley, and for equal transmission the difference will be still greater.

Some of the incidental advantages claimed for these pulleys are reduced friction and wear of shafting, from less tension of belts and weight of pulleys; avoiding waste of power and loss from less product due to the slipping of belts; no tighteners are required, as the pulley may be relied upon to transmit all the power the belt is capable of transmitting.

These pulleys are made by the Paper Pulley Company, Indianapolis, Ind., and sold by Westinghouse, Church, Kerr & Co., 17 Cortlandt Street, New York.

Mr. Purves, an English engineer, read a paper before the Institution of Naval Engineers, on large forgings. Speaking of the different kinds of welds, he gave the preference, for heavy work, to the scarf weld, and considered the long V weld next best. He submitted some large specimens of welds, made by the use of sledge hammers, screws and the steam hammer. Upon trial all the welds broke at a red heat, by being bent, except the one made under the steam hammer, which was repeatedly bent forward and back till black hot, and then broke elsewhere than at the weld.

Eminent metallurgical chemists, experimenting with steel under a powerful microscope, have discovered the relative conditions of the iron and carbon particles in steel. The fine granular appearance of steel, so well known when closely examined under the microscope, is found to consist of a multitude of minute cells, the nucleus of each cell being formed of iron, and carbon forming the outside skin. The investigators who have made this discovery expect to be able, in the course of further researches, to demonstrate the position that impurities such as phosphorus, sulphur, and silicon hold in the structure of steel. This line of inquiry is likely to produce valuable results in showing exactly the structural changes that take place on steel under conditions approximate to what it has to endure in ordinary service. At present there is exceedingly little real knowledge respecting the changes that take place in the internal arrangement of metals under service. The learned discourses on the subject consist mostly of pure hypothesis, which in shop parlance means guessing.

According to the report of the Secretary of the Amalgamated Society of Engineers (British) the monthly returns of men out of work had increased from 1893 in January, 1884, to 4090 in December. The membership at the close of 1884 was 50,681. Stagnation in shipbuilding is made to account for the large increase in members out of work.

Among the papers read at the recent meeting of the British Association of Mechanical Engineers were the following: "Abstract of Results of Experiments on Riveted Joints, with their Application to Practical Work," by Prof. Alexander B. W. Kennedy, London; "Description of the Tripier Spherical Eccentric," by M. Louis Poillon, Paris; "Description of a Blooming Mill with Balanced Top Roll. at the Ebbw Vale Works," by Mr. Calvert B. Holland, Ebbw Vale.

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NEW YORK, MAY 23, 1885

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Activity in Forming Corporate Companies.

Among the recent statistical information fed out to the readers of the daily press is a summary of new corporations organized throughout the United States during the month of March, with amount of capital supposed to be employed. The list is formidable, embracing as it does 1,487 enterprises, with an aggregate capital of $303,647,543. Comparison is made with the month of February, when only 863 enterprises were recorded, with $263,691,543 capital. Apparently this shows an improvement and greater activity in new industrial ventures. Whether it really does show an advance is an open question. Industrial progress is not measured by relative activity in forming new corporations with the ostensible object of engaging in some useful business. By far the greater portion of new corporations never enter upon the work specified in their charters, and their capital exists mainly upon paper. In the summary above referred to we note 25 electrical companies, with $24,771,000 capital; 60 mining companies, with $43,551,000 capital; 21 railroads, with $43,289,000 capital, and 66 miscellaneous manufacturing companies, with $49,560,000 capital. Stock in such companies is believed to be the best to sell, and most of it is created for the sole purpose of selling out. It is an easy matter to get a certificate of incorporation for a stock company, and it costs about the same to make the capital $1,000,000 as it does to make it $1,000, but it makes a deeper impression upon a large part of the unsuspecting public to put it at the former figure. Genuine stock companies for carrying on the business named in their charters are being formed every week, but it is difficult, without special information in regard to each one, to pick out the genuine from the humbug corporations, especially as the latter so largely outnumber the former.

Those who study the Patent Office records frequently find that some device patented years ago has been rejuvenated, so to speak, and a patent for it again issued. A little investigation will generally show that something has been added, and that something is very likely the thing that makes the device of any practical value. The intention in granting a patent is to benefit the public, and incidentally to remunerate the inventor, but not to the extent that the public is benefited. If the inventor fails to make his invention of any value, and eventually some one adds what does make it of value, then the last one benefits the public, and is the one entitled to remuneration.

Prison Labor Legislation.

The Palmer prison labor bill, barely defeated by the present legislature of New York, would have provided, virtually, for a return to the contract system, which the voters of the State decided must go. Politicians, or rather officials, persuaded by the money power behind the contract system, will defeat the will of the people if possible. And in this they are backed by a portion of the press of the State, whose argument is that the popular vote in favor of abolishing the contract system was not large, and that its abolishment has entailed heavy expense upon the taxpayers. As to the vote in favor of abolishment, it may not seem heavy to those who look upon the deluge as "not much of a shower," but to most people it seemed remarkably conclusive. So far as the comparative profit and loss is concerned, no one is competent to judge. Figures have been put forward to show the loss, but they are entirely untrustworthy. The loss, in dollars and cents, will unquestionably be considerable until some efforts are made to employ prisoners profitably, which will not be done so long as those in opposition to the people are in power, because they hope for a return to the contract system by demonstrating that any other will burden the State. Although those who are opposed to enriching a few contractors at the expense of honest labor are greatly in the majority, it is evident that they will have to elect legislators who are honestly in favor of giving some other than the obnoxious contract system a fair trial, instead of those who study how not to do it, and who will vote to return to what the people have condemned, if they can find any apology for doing so with which to go before their constituents. No excuse, they reason, will be so potent as to permit as great loss to the State as possible.

In dull times some machine shops find difficulty in making any profit after meeting all necessary expenses. Competition becomes close, and with an increase in the number of shops comes a shrinkage in the amount of business usually done by many of the oldest and best known shops. But a considerable part of the expenses go on just the same as though they were crowded with orders. Consolidation saves expense and increases profit, in some cases. Two well-known machine-tool building establishments in Philadelphia have just consolidated, and there is no doubt that some others in the same business could consolidate with mutual advantage. Combination cannot be made to work in the machine tool business, but consolidation is always admissible.

Improving the Cowcatcher.

A great many ingenious devices have been produced to supplement the action of the locomotive cow-catcher, in persuading stray bovines to give the resistless locomotive free right of way. The cow-catcher performs its functions fairly well, but it is apt to leave the animals it operates upon in a dilapidated condition. This leads to expense for damages. The inventive genius of the country is wrestling with the problem of leaving the track unfenced, yet, providing the means of removing peripatetic steers and hogs without subjecting them to the rigorous concussion of a hard cow-catcher. One inventor proposed a huge cushioned funnel to be pushed in front of the locomotive, into which stray animals might be caught, and wafted gently back into an elegant chamber prepared for their reception. That did not appear to fill the needs of the railroad world, if we are to judge by the severe way it was left alone.

Another candidate for favor appeared with a rotary cow-catcher, which was to send the trespassing cows over the top of the smoke stack. As the flight might have destroyed the milking qualities of the cows, railroad companies did not take kindly to that idea. Invention was not discouraged with these failures. A patent was recorded for the means of injecting a stream of hot water in front of the locomotive, as a gentle hint to "all and sundry," that worse would befall them if they did not get out of the way of the coming train. That device must have been found wanting in practice, for what may be regarded as a long-felt want has just been afforded protection by the Patent Office. The inventor of the latest improvement proposes to stretch out from the front of the locomotive, a long, lazy-tongs arrangement, which ends with two projecting fingers, one of them holding a whistle, the other a prog. A rubber pipe will convey steam or air to sound the whistle, and if its noise should fail to alarm the cow, the prog will give it a more vigorous reminder to get out of the way.

Any cow stupid enough to neglect the last warning, would receive no sympathy when she brought rougher treatment upon herself.

To the mechanic or engineer the reasons for their faith that are put forth by "investigators" in the direction of electric motors are generally either amusing or absurd. One of these investigators, it is gravely chronicled, has just seen a steam engine in full motion stopped and run backwards by an electric motor! How much his testimony is worth may be gathered from his expression in regard to the steam engine: "I would not have thought any power on earth could stop it." It may readily be imagined that those with a knowledge of mechanics who are working hard on the problem of electric motors, are not particularly jubilant over the "help" they get from those who know nothing about the subject, but who, pecuniarily interested, imagine that they are helping, when, in fact, they are heaping up ridicule that some one with a clear head must remove.

Safety on Elevated Railroads.

At a recent meeting of the New York Board of Aldermen a resolution was passed requesting the corporation counsel to examine the law, and report on the power of the Common Council, to control the operation of the elevated railways, especially with reference to the frequent collisions and consequent danger. This resolution is merely a municipal echo of a sound dinned persistently by a few daily papers that obtain cheap notoriety by abusing the management of the elevated Railroads. Anything that Jay Gould has an interest in, is accepted as a fair target for penny-a-liner shot, and this is no doubt the reason why the elevated railroads are so persistently abused. The structures of these roads are unsightly and the noise of the trains is exasperating to many people residing near the tracks; but those who know anythng about railroad operating are aware that the roads are operated with remarkable care and skill. We believe the whole system of elevated railway built up on iron structures in the middle of leading streets to be a huge mistake; and we do not believe that the structures in New York are destined to stand permanently, expert testimony to the contrary notwithstanding; but while the roads are kept running we consider the press and people ought to give the management credit where it is due. The roads run trains at shorter intervals than any road in the world, and no railroad has ever carried passengers with fewer accidents. "The frequent collisions" complained of, have been two collisions in six months, only one of which was anyway serious. People who talk about frequent collisions that far apart, know nothing about the difficulties of preventing trains from coming together where the interval between them is so short. No system of operating can be perfected that must not depend on human vigilance and intelligence to keep every link in perfect order. It is impossible at all times to keep vigilance awake, and intelligence active. The *personnel* of the elevated railroads is above the average in skill and intelligence, so far as railroad men are concerned, yet the time will never come when these human beings will rise above fallibility.

The general manager, Col. Hain, is an experienced railroad man, who has risen through all the lower grades in the mechanical and operating departments of surface roads. He has a staff of officers and men under him who are selected with special care for their knowledge of the duties they have to do. The engineers, upon whom the responsibility of careful operating principally rests, are men from our leading first-class roads, and none are taken who have not the best recommendations for skill and good character. From intimate personal intercourse with a great many of these men, we are able to testify to their high standing as locomotive engineers; yet occasionally they fail in vigilance or judgment at a critical moment. If systems of railroad operating were perfect, and human beings controlling the machinery were infallible, and material were reliable under all circumstances, there ought to be no accidents on any railroads. As this perfection has not yet been attained, accidents will happen, and so long as they continue so rare and so light as they have hitherto been on the elevated railroads of New York, the public ought to be satisfied. If they ever should be induced to let the Board of Alderman handle the operating of the roads, they will come to know something better about the capabilities the roads have for bad accidents.

It is said that the tin plate used in the United States, if manufactured here, would give employment to more men than are em-

ployed in all the steel industries of the country. If the tin mines already discovered are as valuable as it is believed they are, the United States will soon be a great tin-producing country, and in a few years should make her own tin plate.

For a long time it was feared that a sufficient sum to build a suitable pedestal for the Bartholdi Statue of Liberty could not be raised in time to have the pedestal complete when the statue should arrive. The Committee intrusted with the raising of the necessary $100,000, worked hard, but with meager results. Then newspaper enterprise came to the rescue. The New York *World* started to raise the money by numerous small subscriptions, and has kept holding out the plate persistently before the public, every day, until they have collected over $44,000, and still the good work goes on. Subscriptions average about a dollar each, and they come from people in almost all useful occupations, those engaged in the machine and tool industries being well represented. As the *World* is virtually unsupported in its efforts to swell the fund, by the other metropolitan journals, it deserves and will receive all the credit for carrying its enterprise to a successful culmination.

According to returns made to the Board of Trade by the railway companies in Britain, the number of persons killed on railways last year was 1134, of whom 135 were passengers. Of these a larger proportion—24 passengers—were killed by the breakage of axles than by any other single cause. There were 385 such breakages, of which 223 were engine axles. There were reported 57 cases of passenger trains leaving the rails, and 88 collisions between trains. The number of reported failure of tires was 1060, most of them being car tires.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(155) **J. U., Philadelphia, Pa., asks:** In what number of the AMERICAN MACHINIST is there an article on lining up shafting? *A.*—Nov. 1, 1879.

(156) **A. B., Lawrence, Kas., writes:** I am making a small engine. 2½″x3½″. What size boiler will be right for it? *A.*—Boiler 22″ diameter and 42″ high, will probably answer.

(157) **E. H. D——, N. Y., asks:** How can I temper long taps without springing? *A.*—See Questions and Answers, Nov. 29, 1884; also communication on page 4, Dec. 27, 1884.

(158) **J. W. R., Liberty, Va., says:** If a locomotive engine is being towed with the motion reversed, will she pump air into the boiler till the pressure raises the safety valve. *A.*—Yes.

(159) **J. B G., Philadelphia, Pa., asks:** 1. What is the fastest railroad speed on record? *A.*—About 76 miles an hour. 2. What is the best locomotive, all things considered, the American or English? *A.*—That depends upon the taste of the man making the choice. We prefer American.

(160) **A. L. F., Water Valley, Miss., asks:** 1. Where can I get a weekly or monthly publication on drawing? *A.*—There is no such periodical published. 2. Where can I get some information on making blue prints? *A.*—You will find instructions in the AMERICAN MACHINIST of October 8, 1881.

(161) **J. ———, ———, asks:** Can four men, with a 12-foot lever, force a car wheel on a 2½″ shaft, turned 1-64″ scant larger than hole in wheel? *A.*—We cannot tell. The proper allowance for a 2½″ shaft, if the eye is properly backed with metal and four or five inches in length, would be about 6-1000 of an inch, shaft and hole being smooth.

(162) **A. M., St. Paul, Minn., writes:** We have some light steel castings. How can we harden them? *A.*—There is great difference in so-called steel castings as regards hardening. Some will harden at a low red heat, the same as forged cast steel; some will harden by using prussiate of potash, or will case-harden, like wrought iron. The parties who make the castings can doubtless give you the necessary information.

(163) **W. R., Minonk, Ill., asks:** How are cast-iron pins in crossheads turned? *A.*—The most common way is to mount the crosshead on the centers of a lathe, then fit a lever in the eye: set a tool and oscillate the crosshead, start the lathe and put on feed; then turn the crosshead around on the centers to finish turning the pin. Another plan, which we recently saw employed at the works of Hewes & Phillips, Newark, N. J., is as follows: Four spots are planed across the pin, so as to divide the surface into four parts and make the diameter that required. The crosshead is then made fast to the face-plate of the lathe, true with the spots. A pin is inserted in the face-plate of the lathe, and also in the faceplate of another lathe in line with this one. A connecting-rod connects these two pins. The second lathe is started, and (the pins being properly located) it oscillates the face-plate and cosshead sufficiently to turn one-quarter of the pin, then by changing the pin in the face-plate another quarter is turned, and so on.

(164) **W. S. Sherbrooke, Canada, asks:** 1. What size engine and boiler will be required for a boat 25 feet long and 5 feet beam? *A.*—You can use an engine 3″x4″, boiler 28″ diameter and 46″ high. 2. What should be the ports and bridges? *A.*—Steam ports, ¼″x2½″; exhaust port, ½″x2½″; bridges, ¼″, will do very well. 3. What motion for reversing would do in place of the link? *A.*—We should advise you to use a link. 4 What size and pitch of screw shall I use? *A.*—Screw 24″ diameter and 28″ pitch will probably do. 5. How fast should it run? *A.*—As fast as the engine will turn it. 6. What would be the best for fuel, coal, or a lamp with a number of wicks? *A.*—Coal. 7. Will you give me some rule for the horse-power of boilers and engines? *A.*—There is no rule for horse-power of boilers. The horse-power of an engine is the area of cylinder in square inches, multiplied by the piston speed in feet traveled per minute, and by the mean effective pressure in the cylinder, and divided by 33,000. As an approximation, the mean effective pressure may be taken as half the boiler pressure.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Curtis Pressure Regulator and St'm Trap, May 9, p 10

Katzenstein metallic packing, 169 Christopher st, NY

Edw. Sears, wood engraver, 48 Beekman, St...N.Y

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Tools for amateur and foot-power lathes. Send for illustrations. Hartford Tool Co., Hartford, Ct.

Light fine interchangeable mach'y to order. Foot lathe catalogue for stamp. E. O. Chase, Newark, N.J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Split pulleys cheaper than plain ones. Trial orders solicited. York & Benton, Cleveland, Ohio.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham St., N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught," $4. Books for workmen Joshua Rose, Box 3306, New York City.

Morrison's Practical Engineer, a complete treatise on steam and general machinery. (See AM. MACHINIST, Vol. 8, No. 18, p. 8). Price, $1; mailed free. W. A Morrison, Box 373, Lowell, Mass.

Useful Information for Steam Users—A 100-page pamphlet, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Every engineer should have this book. Send 25c. in P. O. stamps to the J. N. Mills Publishing Company, 145 Broadway, N. Y.

Locomotive Engine Running and Management. By Angus Sinclair. Price $2. An excellent book for men interested in steam engineering, valve setting, designing valve motion, the care of the Westinghouse brake, etc. Published by John Wiley & Sons, 15 Astor Place, N. Y.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies

MANUFACTURES

Morganstown, W.Va., will build water works and put in a pumping engine.

A. Cutter & Sons, Buffalo, N. Y., are building a $40,000 furniture factory.

A. W. Hager & Co., Charlestown, W. Va., have completed their new foundry.

Moffett & Son, Lancaster, Texas, will soon build a flour mill at Waxhachie, Texas.

Thirty-five men are employed at the Goss Marine Iron Works, Bath, Me., at present.

The McNeal, Annis Co., McPherson, Kansas, will build an addition to their foundry.

James McNeil & Bro., Pittsburgh, Pa., are erecting a machine shop and boiler shop.

Duvall & Co., Zanesville, Ohio, talk of moving their engine works to Kansas City, Mo.

The Vicksburg, Shreveport & Pacific Railroad shops at Monroe, La., are being enlarged.

Tyler, Tex., is about to have a cotton compress; $50,000 has been subscribed by the citizens.

The Pratt & Whitney Co., Hartford, Conn., have received a foreign order for 100 Gardner machine guns.

Smith, Worts & Co., Oswego, N. Y., will erect a box factory worth $50,000. New machinery will be put in.

Freer & Casey's foundry at Battle Creek, Mich., recently destroyed by fire, will be rebuilt this spring.

The Chattanooga, Tenn., Saw Company are building a fine new factory, and will increase their capacity.

The Jacksonville, Tampa & Key West Railroad is building a round-house and small machine shop at Jacksonville, Fla.

Berry & Foote's roller mills, at Adrian, Mich., ship two or three carloads of flour weekly to Ireland upon a contract.

Matthew Malloy writes us that he will start a machine shop at Clayton, Jefferson County, N. Y., about the 1st of May.

The Crane Brothers' Manufacturing Company, of Chicago, have given their employes an advance of ten per cent. in wages.

The car shops of the Detroit, Grand Haven & Milwaukee Railroad have been removed from Detroit to Fort Gratoit, Mich.

The Marvin Safe Co., 265 Broadway, N. Y., will erect a new factory, to take the place of their works recently burned out.

The Pratt & Whitney Co., Hartford, Conn., are now employing 15 draftsmen and 10 patternmakers on regular and special work.

The Foster Stove Works is a new corporation in Ironton, Ohio, that has purchased land and will build works. The shop is to be 60x140 feet.

The Burlington (Iowa) Rolling Mill has commenced operations with a capacity of ten tons of bar iron per day. This is the first rolling mill in the State.

Jas. Wild & Company, 90 Thomas Street, New York, will erect a 50x70 foot mat factory on Kosciusco Street, Brooklyn. It will be three stories high.

It is reported that Van Winkle & Co., of Atlanta, Ga., will establish branch iron works in Dallas, Texas. So says the *Baltimore Manufacturers' Record*.

The Oliver Chilled Plow Company, of South Bend, Ind., has voluntarily advanced the wages of its employes to the rates paid before last November's reduction.

D. B. Kelley is erecting a manufacturing establishment in Sylvester, Mecosta County, Mich., in which he expects to manufacture woodenware of various kinds.

C. A. Stevens & Co., woolen manufacturers at Ware, Mass., will put up a three-story brick building, 35 by 80 feet, in place of one of their buildings recently burned.

E. H. Funk, of Sturgis, Mich., will build a two-story machine shop and a foundry at Toledo, Ohio. Over 50 men will be employed.—*Grand Rapids Morning Telegram.*

Robinson, Rea & Co., Pittsburgh, Pa., will have a new machine shop, 180x50 feet, with a wing on each side 180x25 feet. It is expected the new shop will be ready for operation June 20.

The Taunton Locomotive Works have just turned out a large freight engine No. 131, for the Old Colony Railroad. Her cylinders are 18x26, 52-inch boiler, 5 feet standard driving wheels.

Mr. J. L. Perry, formerly of J. L. Perry & Co., has retired from that firm, and has formed a stock company at Watertown, Wis., for the manufacture of patent wood-working machinery.

Jos. Reichter, 9 and 11 East 9th Street, Cincinnati, Ohio, will erect a factory at 8 to 12 East 9th Street, Cincinnati, Ohio, to be fitted up for the manufacture of brass goods. Estimated cost, $18,000.

The Salmon Falls, N. H., foundry is to have a new moulding shop, which will accommodate 14 additional moulders; a new carpenter shop and pattern room, and a new coal and iron storehouse. The foundry is now using 6 tons of iron and one ton of coal per day.

The Brenham (Tex.) *Banner* says: "A firm from Atlanta, Ga., has purchasad an acre and a-half of land in East Dallas, and will at once erect an extensive manufactory of cotton gins, presses, saw mills, etc."

The Lidgerwood Mfg. Co., New York, say their sales for the past three weeks have averaged three engines a day. They are running full time, and if this state of things continues will soon have to run their works overtime.

The McAndrews Sanitary Company, of Youngstown, Ohio, have recently purchased, and are now operating, the Novelty Foundry Works. They make, in addition to their sanitary specialties, general iron and brass castings.

The Novelty Iron Works, of Dubuque, Iowa, recently shipped six carloads of boilers and mill machinery to parties in Rat Portage, Ontario, Canada. This machinery was sold in competition with Canadian prices and 25 per cent. duty.

The W. C. Vosburg Manufacturing Company will soon erect a 6-story brick and stone front factory and showrooms, 28x90 feet, on Fulton Street, Brooklyn, N. Y. The work of demolishing building on present site has already commenced.

The machinery for the new machine shops in Piedras Negras, Mexico, of the International Railroad, is beginning to arrive. These shops, when completed, will be first-class ones, and the first cost will probably be about $35,000.

The purchasers of the U. S. musket factory, and of the Potomac River water power, at Harper's Ferry, will erect a mill for the manufacture of ground wood pulp. Their plan is to put in six turbines of 250 horse-power each, and attach two grinding machines to each wheel.

The Buffington & Depew Machine Shops, the largest shops in St. Paul, Minn., will probably be removed to Brainerd. Recently the 237 lots comprising the entire Schwartz addition in East Brainerd passed into the hands of Messrs. W.W. Hartly, Buffington, and C. N. Parker, and the machine shops of Buffington & Depew will be located upon them. —*Industrial World.*

The Chicago branch of the Niles Tool Works has removed to the new ten-story fire-proof building erected by the President of that company, and known as the Gaff Building. It is opposite the La Salle entrance to the Grand Pacific Hotel. This branch also represents the Gordon & Maxwell Co., of Hamilton, Ohio, and the Morgan Engineering Co., of Alliance, Ohio.

The Cincinnati, New Orleans & Texas Pacific Railroad Company have bought the right from the Columbus Iron Works to manufacture 4,000 Raoul's diamond journal boxes. This will make 12,000 of these boxes in use on this railroad. In a recent letter to the Columbus Iron Works, Mr. John Scott, President of the above railroad, expresses himself "highly pleased with the boxes in use."

The Columbus (Ga.) Iron Works Company are building one of H. D. Stratton's ammonia ice machines for the newly incorporated Leesburgh Ice Company, Leesburgh, Fla. Capacity, five tons of ice daily. They have also contracted to furnish two engines, and all the machinery and boilers, for Hearn & Co., who will build a ferryboat on the Alabama River, above Montgomery, Ala.

W. A. Walden, Master Mechanic of the East Tenn., Va. & Ga. R. R., writes us: "We have a very good machine and blacksmith shop in operation at Atlanta, which employs about 200 men, and expect to commence operations on a wood-working shop about June 1 for repairing and rebuilding cars. This will employ about 100 additional men. We do not expect to build anything at Rome except a roundhouse and very small repair shop."

The New Era Gauge Co. are soon to erect a large 4-story brick building on Church Street, Buffalo, N. Y., to be connected with the present building on Mechanic Street. When finished, the buildings will have a floor space of over 62,000 square feet. They are putting in a large amount of new machinery, all of the most improved patterns. A specialty is made of duplex steam pumps and fine machine work. On June 1 the name New Era Gauge Co. will be changed to the Volker & Felthousen Manufacturing Co.

The St. Louis *Age of Steel* says: "The rolling mill and forge works enterprise, with which the Great Western Railroad Supplies Company was identified in East St. Louis, has been revived by an organization styled the Western Forge and Rolling Mill Company, having a capital of $50,000. At a meeting of the new company on Saturday of last week, officers were elected and contracts let for the erection of works. Mr. John Wilson, one of the best known practical hammersmen in the country, and formerly in the employ of the Helmbacher Forge and Rolling Mills Co., is the official head or president of the enterprise. Interested with him are Geo. S. Foster, of the Fairbanks Scale Company, city; Mr. Heims, brewer, East St. Louis; James H. Mackie, carpenter and millwright, and several others, including two or three ladies. The last named gentleman informs us that he has been awarded the building contract, and that the main structure will be 60x154 feet, with outlying boiler sheds. The new company succeed to the land grant of six acres and all other property and privileges that may have been gratuitously conferred upon, or have been purchased by, the old organization. The list of manufactures will be the same as that had in view last summer when the enterprise was left off, comprising heavy forgings of all kinds, railroad supplies, steamboat shafts, etc."

Machinists' Supplies and Iron.

NEW YORK, May 7, 1885.

There is no change to note in the supply business. Dealers work hard for orders, and accept them at remarkably small margins. There is altogether considerable business doing, but the profits are not satisfactory. Dealers are looking for better times, just as they have been doing for the last year.

Manufacturers are, in some instances, quite busy, but as a rule are working a good deal behind the limit of their output.

Iron—There is no change in the American pig iron market. The demand is no stronger than it has been for the past months, and prices rule in favor of the buyer. In standard brands the production is kept close to the requirements, and little or no stock is accumulating. We quote No. 1 X Foundry, Standard Lehigh Brands, $18 to $18.50; No. 2, $17 to $17.50; Grey Forge, $14.50 to $15.50.

Scotch Pig is in small demand, transactions being confined to small lots at retail. Quotations are: Shotts, $21 to $21.50; Coltness, $21 to $21.50; Glengarnock, $19 to $19.50; Gartsherrie, $20.50; Summerlee, $20.50; Carnbroe, $19, to arrive; Eglinton, $18 to $18.50.

Copper—Ingot rules fairly firm at 11½ cents for Lake; other brands 10.80 to 11 cents.

Tin—Prices for ingot have fluctuated through the influence of foreign markets, and the demand has been limited. For jobbing lots we quote: Banca, 19 cents; Straits and Malacca, 17.80 to 17.90 cents.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Situation as foundry supt. or foreman. Address D. E., Am. Machinist.

Position wanted as foreman or superintendent; can design and build machinery, especially woodworking. Address Nailor, Box 11, Am. Machinist.

Practical machinist would like situation; has had some experience in tool-making; good recommendations. Address A. A. C., Box 92, Johnson, Vt.

An experienced man desires an engagement with some live company as superintendent; best references as to ability. Address Progress, Am. Machinist

A first-class salesman would like to represent a good firm; well acquainted and good mechanic. Address Business, Am. Machinist.

Foreman of an iron foundry doing heavy and light work wishes to correspond with parties wanting a foreman. Address P., Am. Machinist.

The numerous applicants who have answered the advertisement of "Quaker City," are notified, with thanks, that an engineer has been engaged, filling the vacancy for the present.

Wanted—An A1 machinist and toolmaker. Address, giving age, married or single, references, wages expected, and full particulars as to ability and past experience, Box B., Vineland, N. J.

Mechanical engineer desires position as superintendent; has good experience in designing and building special machinery; also mills, machine shops, etc. Technical education. Address J., Am. Machinist.

Wanted—Foreman competent for a large machine shop; must be of good executive ability, habits and character. Apply by letter, stating age, experience, where and in what capacity last employed, references and wages required, to H. H. H., Am. Machinist.

Draftsman Wanted—Must be experienced in practical machine design and construction, and should have some theoretical training also. Position permanent. Address, stating age, past experience, references, and compensation expected. The Yale & Towne Mfg. Co., Stamford, Conn.

Wanted—Superintendent in machine shop; one conversant with printer's machinery preferred; one capable of getting trade and retaining it, and having $3,000 to $4,000 to invest; can have good situation and a percentage or interest in business. Address "Press," Am. Machinist.

Moseley & Co., Elgin, Ill, would like description and price of small heating and annealing furnace or muffler, about 14x20-inch.

For Sale—An interest in three separate inventions on car brakes. For particulars address J. J. Henry, No. 3 Second Street, Baltimore, Md.

To make room for larger tool, will sell cheap, for cash, a planer 42"x42"x12', in good order. Address P. O. Box 2085, Bridgeport, Conn.

Fly-wheels for sale—Two fly-wheels, 20 feet diameter each weighing about 40,100 pounds. Address A. Y. N., care Am. Machinist.

For sale cheap, to the right man, half-interest in small foundry and machine shop, doing good business; practical machinist preferred. Address Box 1106, Danville, Ill.

For Sale—Thompson's indicator, planimeter, pantograph, Bacon's attachment; all in perfect order, and but little used; cheap. Address Box 12., Am. Machinist.

At a bargain, Moseley's power jig saw, in first-class order; also an "American" steam motor engine, about ¼ horse-power. Apply to James T. Pratt & Co., 53 Fulton Street, cor. Cliff, New York.

Partner Wanted—A competent mechanic of executive ability, with $5,000, to take an interest in a manufacturing concern as foreman or superintendent of work rooms. For particulars, address Mechanic, P. O. Box 1552, Cincinnati, Ohio.

Machine shop for sale in Philadelphia, manufacturing new goods; plenty of orders on hand and in prospect; shop and tools worth $5,000; will sell cheap for cash; large room; low rent; good light and power; good opportunity for man with small capital. Address P., 4221 Columbia Av., Phila., Pa.

Wanted—An experienced, energetic man, with some capital, to work up and manage a new concern to manufacture, under new patents, steam power agricultural implements, road engines and binders. Good location; no risk. Address B., Am. Machinist.

CHANDLER & FARQUHAR,
168 Devonshire St., Boston, Mass.,
AGENTS FOR THE
Barnes' Wood and Iron-Working
MACHINERY,
Lathes,
SCROLL and CIRCULAR SAWS,
UPRIGHT DRILLS, MORTISERS, &c.
Machines sent on Trial.
Also Dealers in Supplies & Tools for Mechanics & Amateurs.
SEND FOR CATALOGUE B.

BRADLEY'S HEATING FORGES.

For Hard Coal or Coke. Indispensable in all shops to keep **Bradley's Cushioned Hammers** and men fully employed and reduces cost of production.

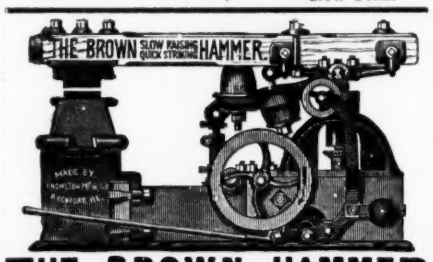
BRADLEY & CO. Syracuse, N.Y.

SPECIAL NOTICE.

All parties making, selling or using an Upright or Helve Power Hammer having a Cushioned Vibrating Saddle, infringe our patents, and we shall hold them legally liable for the same.

BRADLEY & COMPANY, Syracuse, N. Y.

The Fireman's Guide.
A Handbook on the
CARE OF BOILERS
By KARL P. DAHLSTROM, M. E.
Crown 8vo, Cloth, 50 Cents.
E. & F. N. SPON, 35 Murray St., New York.



THE BROWN HAMMER
STRIKES A BLOW WITH
DOUBLE THE VELOCITY That it Raises the Hammer
A NEW MOVEMENT! SEND FOR DESCRIPTION.
KNOWLTON MFG. CO., King St., Rockford, Ill

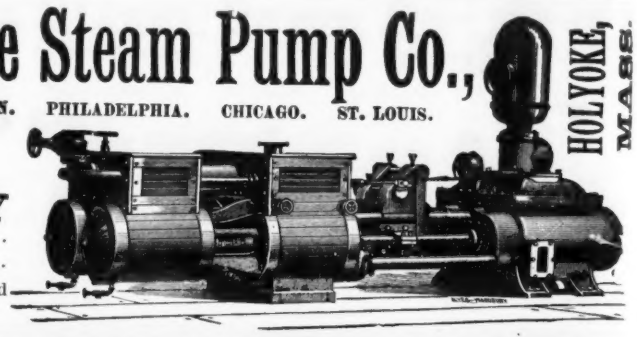
FOR SALE—MACHINE SHOP AND FOUNDRY, located at SELINS GROVE, PA. Building 100 x 45, of which 60 x 40, one-story high, is foundry; 40 x 40, two-story high, is machine part; all brick; a good, substantial building. There are tools of all descriptions, engine and boiler, cupola, &c., in good order. The above valuable property CAN BE BOUGHT CHEAP, at terms to suit purchaser. A live party can get all the work wanted. Any information desired will be given. Address,
H. E. RICHTER, Selins Grove, Pa.

STEPHENS VISES.

50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the improved taper, pipe and other attachments. Sold by the trade. Send for circular.
MELVIN STEPHENS, Prop'r,
Office, 41 Dey St., New York.

Massey's "E AND K" PATENT VISES

The Deane Steam Pump Co.,
HOLYOKE, MASS.
NEW YORK. BOSTON. PHILADELPHIA. CHICAGO. ST. LOUIS.
MANUFACTURE
PUMPING MACHINERY
FOR ALL DUTIES.
Send for New Illustrated Catalogue.



Established in 1874.
CLEVELAND TWIST DRILL CO.
24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
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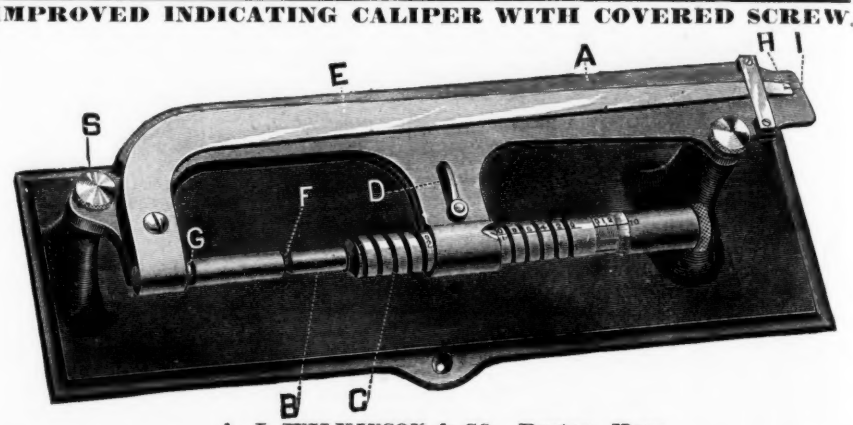

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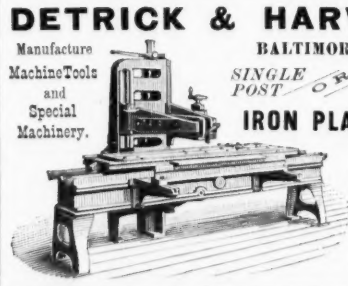

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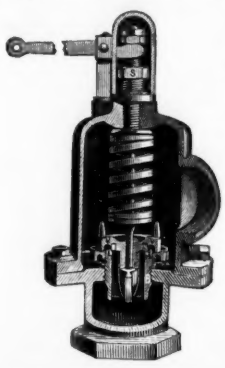

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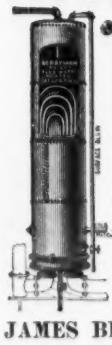

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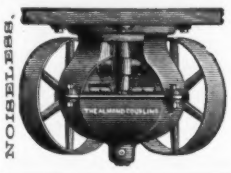

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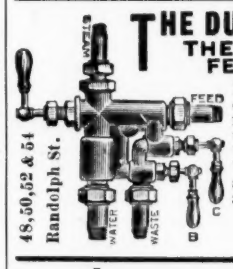

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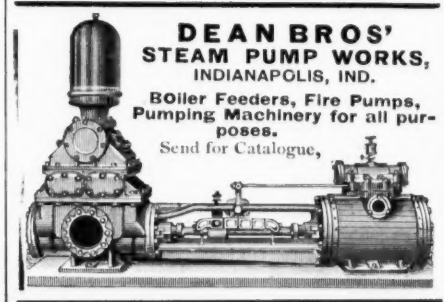

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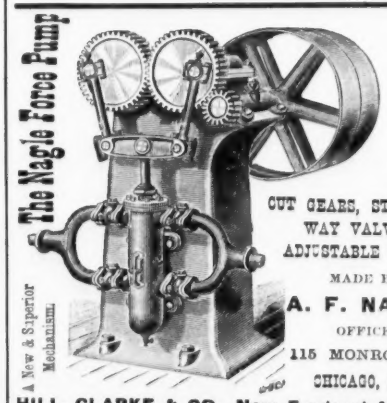

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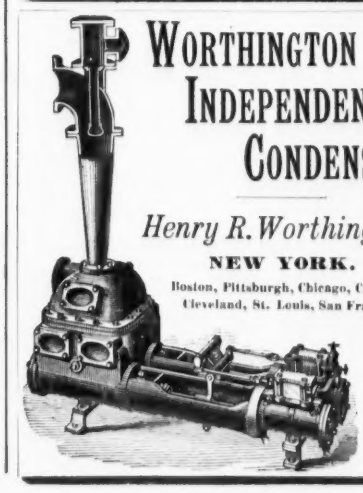

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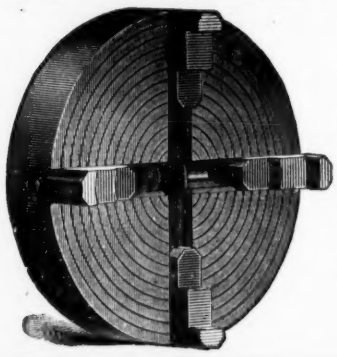

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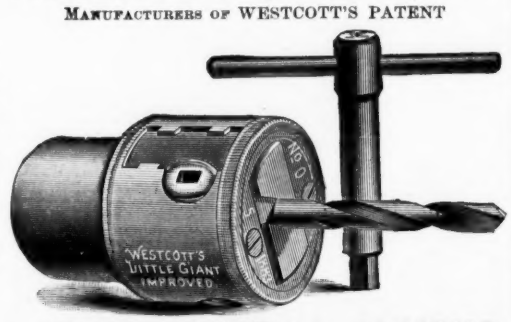

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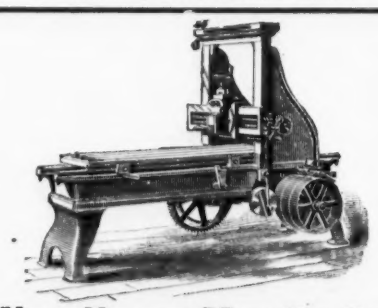

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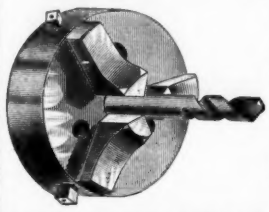

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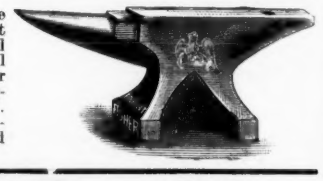

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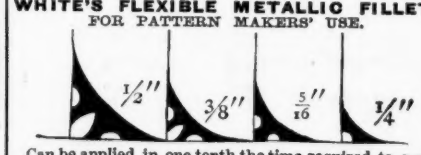

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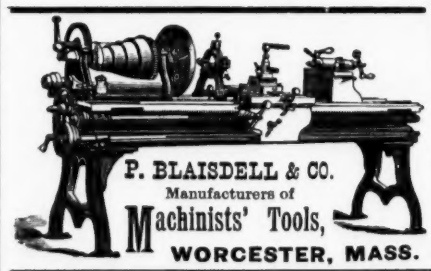

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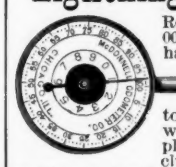

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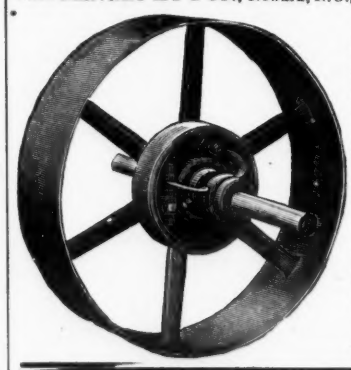

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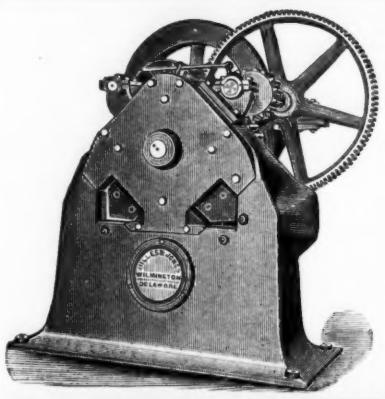

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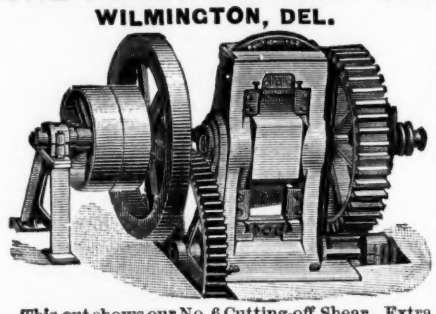

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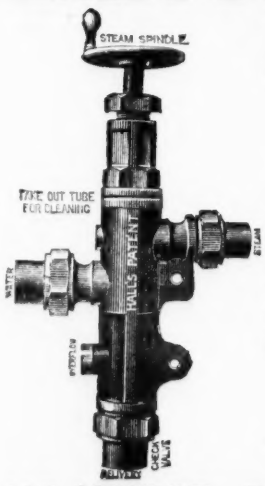

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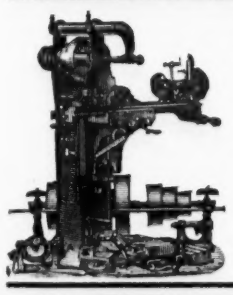

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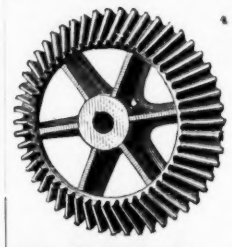

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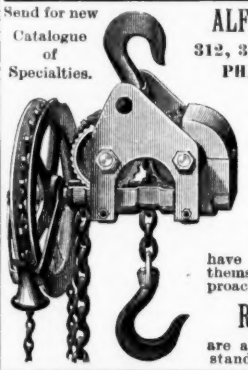

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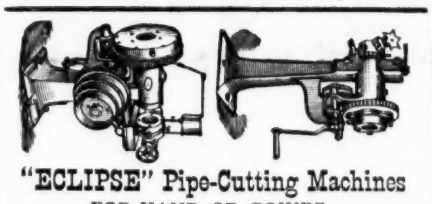

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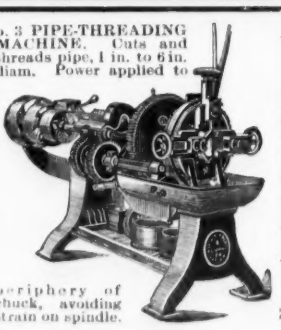

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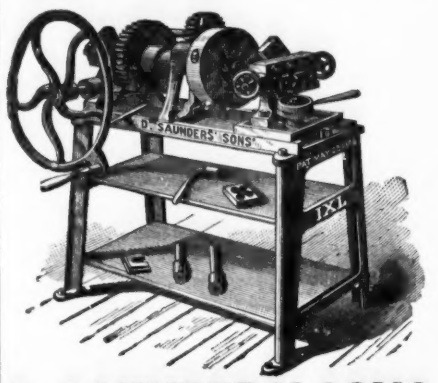

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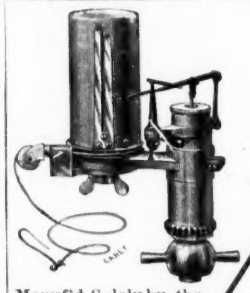

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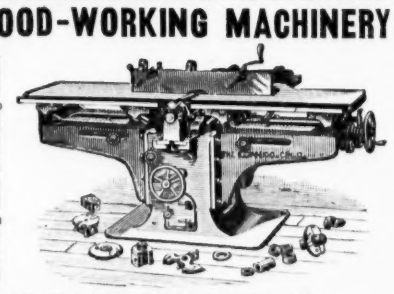

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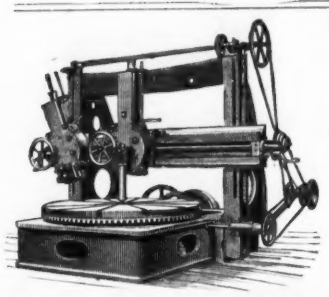

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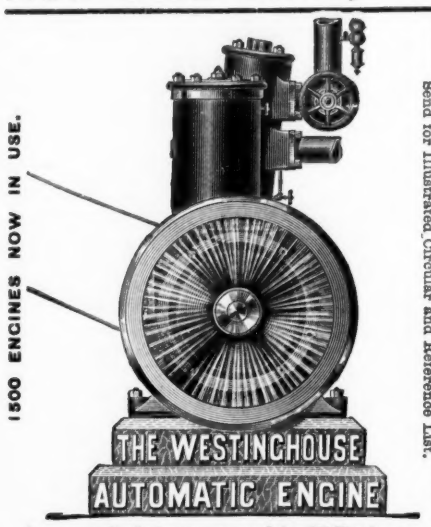

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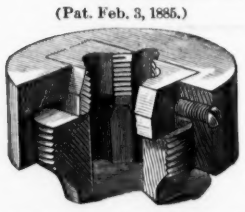

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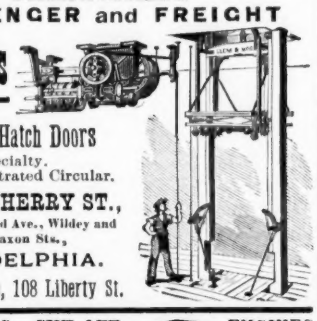

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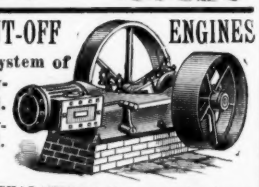

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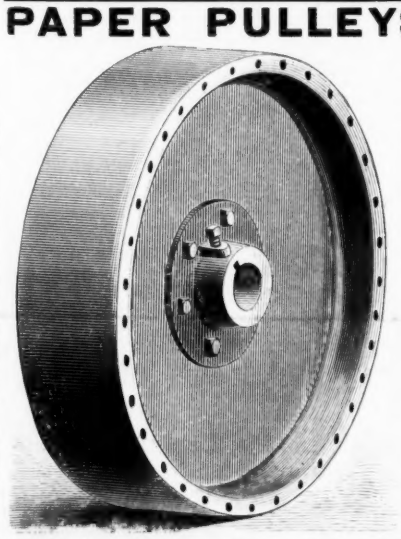

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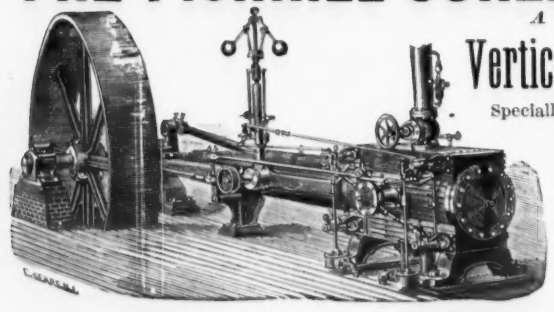

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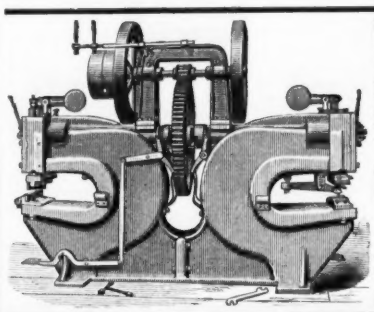

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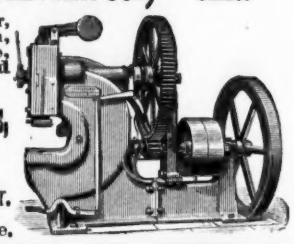

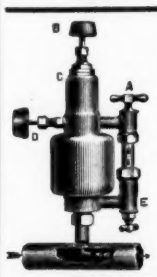

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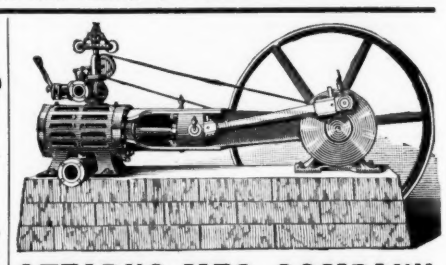

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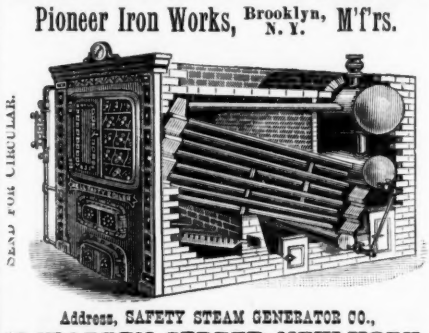

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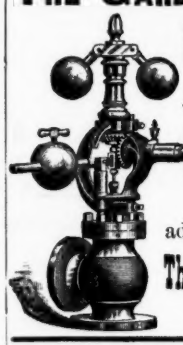

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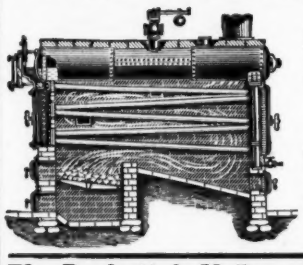

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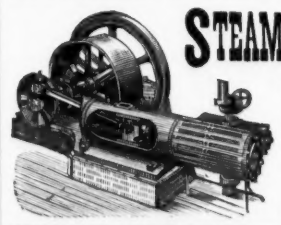

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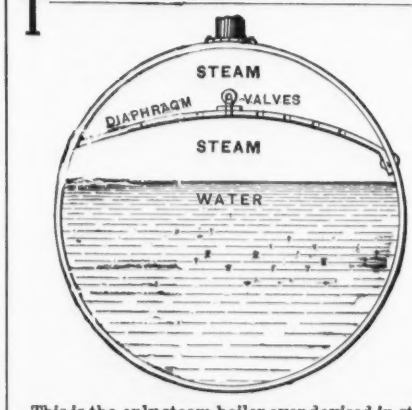

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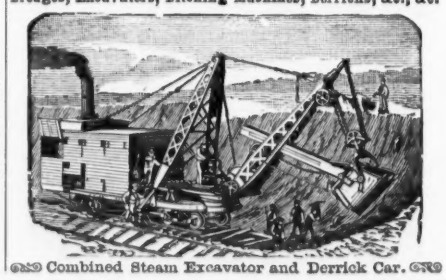

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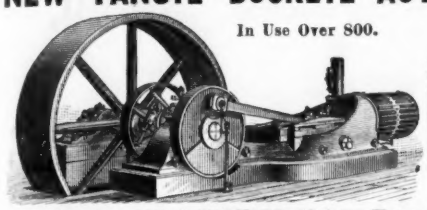

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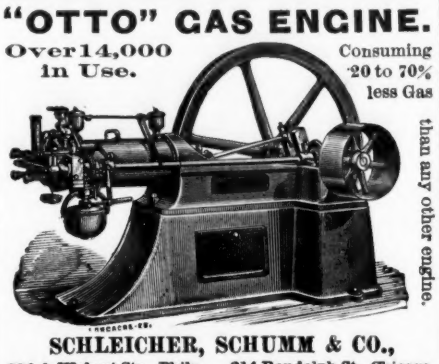

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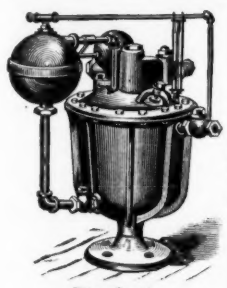

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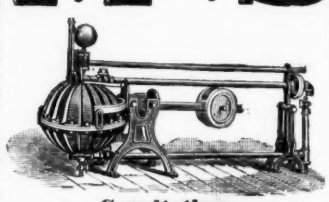

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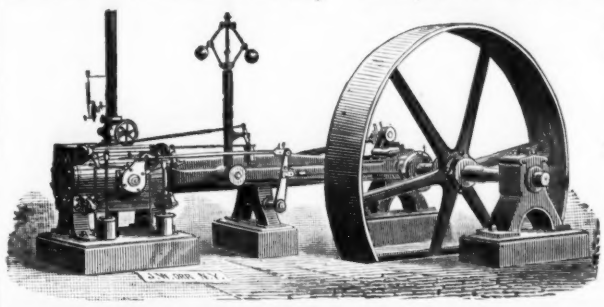

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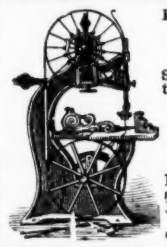

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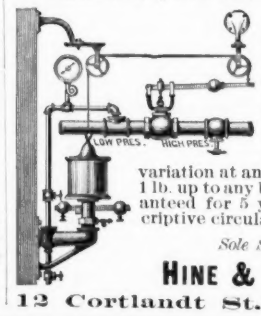

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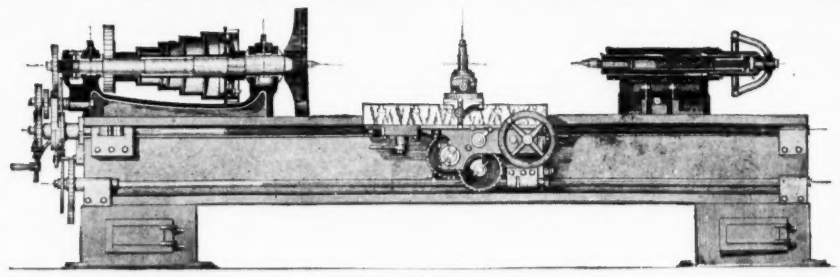

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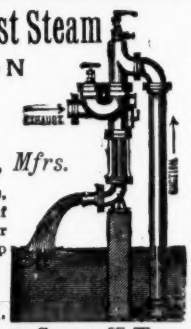

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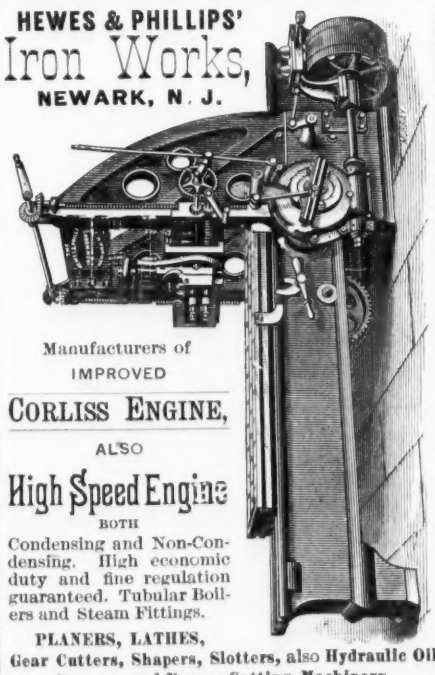

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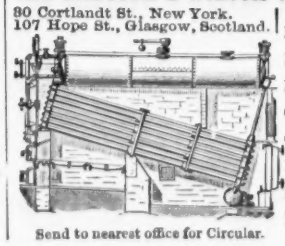

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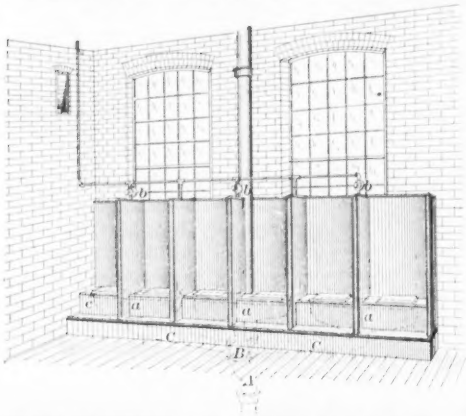

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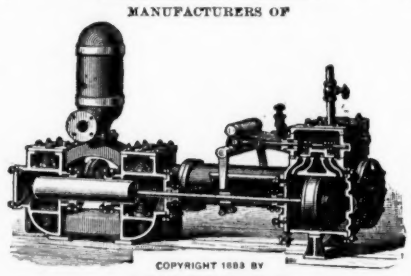

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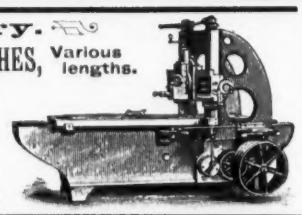

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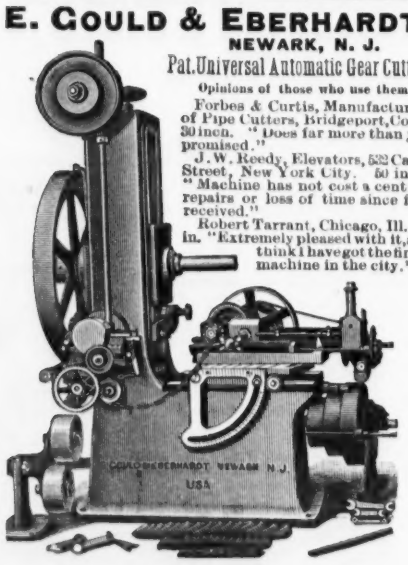

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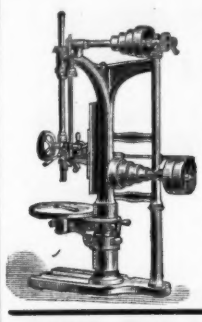

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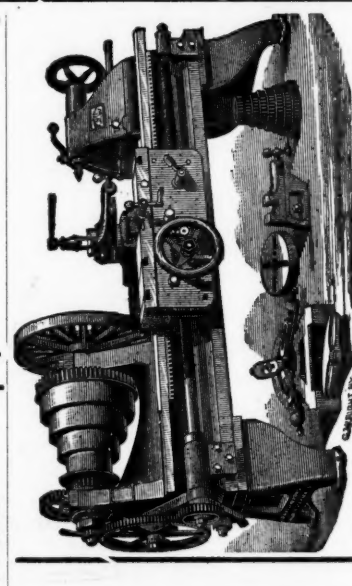

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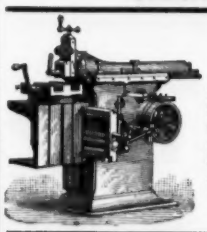

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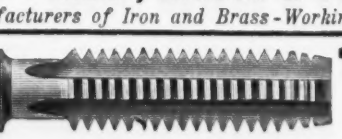

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